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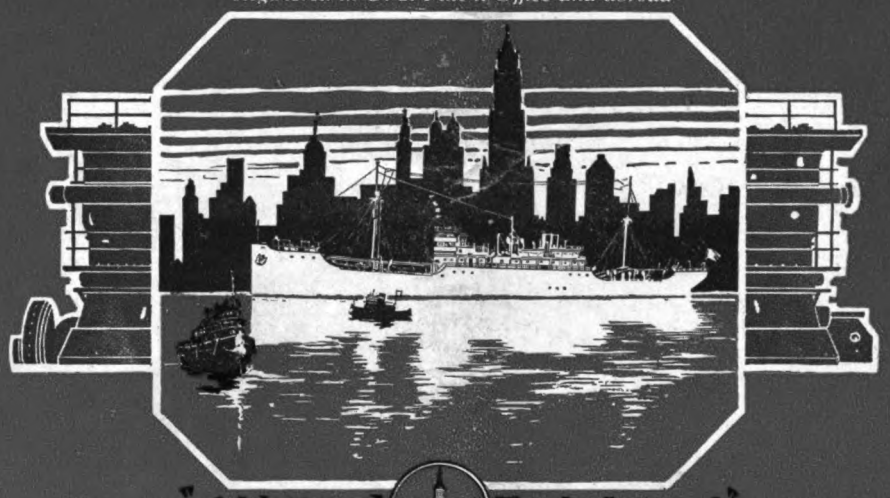

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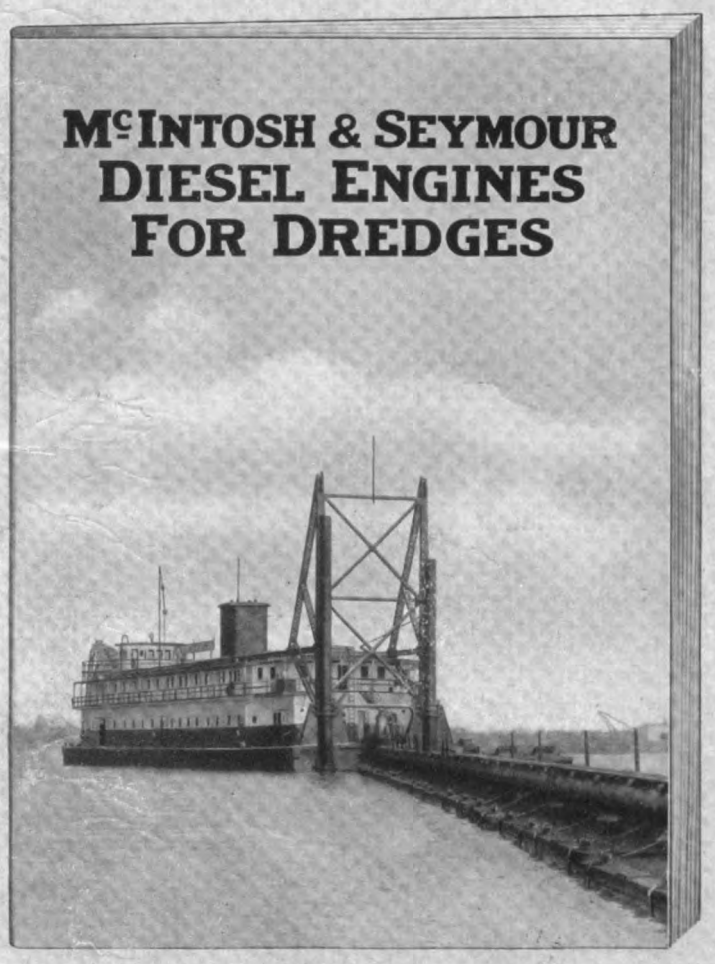

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The German High-Speed Diesel Cruiser

IN its September issue, MOTORSHIP was enabled to publish initial information that the German Admiralty is having eight Diesel engines aggregating 70,000 s.hp. installed in a high-speed cruiser. Further details are now getting the light of publicity. "Fairplay" says that the hull will be welded, and without a single rivet, under a system developed by the Wilhelmshaven Navy Yard. This will reduce the hull weight by 10 per cent; the fuel-bunker weight will be reduced to one-third, and the Diesel machinery also will effect weight saving. The Diesel engines, two per shaft, will be constructed by the motorship building firm of Deutsche Werke at Kiel, which now occupies the old Imperial navy yard. This company should not be confused with the Deutsche Werft at Hamburg, where many motorships also have been built since the war.

This new naval vessel marks a tremendous engineering advance. Not only are her eight Diesel engines three times as powerful in aggregate as those in the motorliner AUGUSTUS, but never before has a hull approaching this size been welded. Herr Presse, Chief of Naval Operations, at Berlin, advises us that as yet the Department is unable to release data on the engine-room installation. The high-speed, double-acting Diesels of the new motorliner ST. LOUIS and MILWAUKEE are affording the German Navy Department great experience, just as the MT. VERNON and MONTICELLO would to our own Navy Department if the Shipping Board converted them to Diesel power of latest Americanized German design as planned.

Ships of Tomorrow

DREAMS of today are practical tomorrow. Without the keen foresight and vision possessed by many of our business and engineering executives, there would be little progress in this world. Defending what he visualizes as a sound and constructive plan of four-day transatlantic travel by ship, or two days by ship and plane, Laurence R. Wilder gave an interesting address at the Propeller Club, New York, last month. Mr. Wilder's proposals are somewhat in advance of ship-operating practices of today, consequently they have not been received without caustic criticism. Yet the same critics will laud a three and four day plan for dirigible airships of the GRAF ZEPPELIN type, regardless of the fact that passenger liners of the "SARATOGA type" proposed by Mr. Wilder will be able to make the trip in conjunction with landing planes in shorter time than airships, with far greater certainty, safety and comfort. Powered by Diesel, or Diesel-electric drive Mr. Wilder's ships would be the last word in liner construction, and would have an added factor of economy.

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Volume XIII — *November, 1928* — *Number 11*

Diesel-Electric Tugs Cut Towing Costs

Fleet of Five Towboats Yield Performance Nearer 100% Than Any Tugs Ever Known

By R. W. Crowly

DIRECT savings amounting to between one-fifth and one-third of the operating costs of steam tugs are credited to the use of Diesel-electric tugs by one owner of tugs of both types in service in New York harbor, and the indirect savings now making themselves apparent will enhance the economies still more. These figures are based upon an experience beginning in 1924 when the first of the Diesel electric towboats was placed in operation and broadening rapidly now that a total of five of this type are in service, with more building, as well as another owned by a subsidiary company.

Direct savings show plainly in the cost of fuel, labor and maintenance of the steam and Diesel-electric boats respectively for the same period of effective work. Indirect savings of the nature of a reduction in overhead charges, a diminution in the insurance burden, a notable decrease in the replacement of rope, etc., are now showing themselves in the accounts. But their exact value must remain indefinite until the operations over a longer period of time will afford a broader basis of determination, so they are not included in our figures.

Working 24 hours a day, seven days a week, these tugs are yielding a performance nearer 100 percent than any boats ever known. Routine engine inspection and overhaul are made without interruption of their service, and even the repairs or replacements which all mechanical equipment require from time to time are made while the boats continue in operation. Only when the date arrives for them to be taken out of the water to have their bottoms cleaned and painted is their service interrupted.

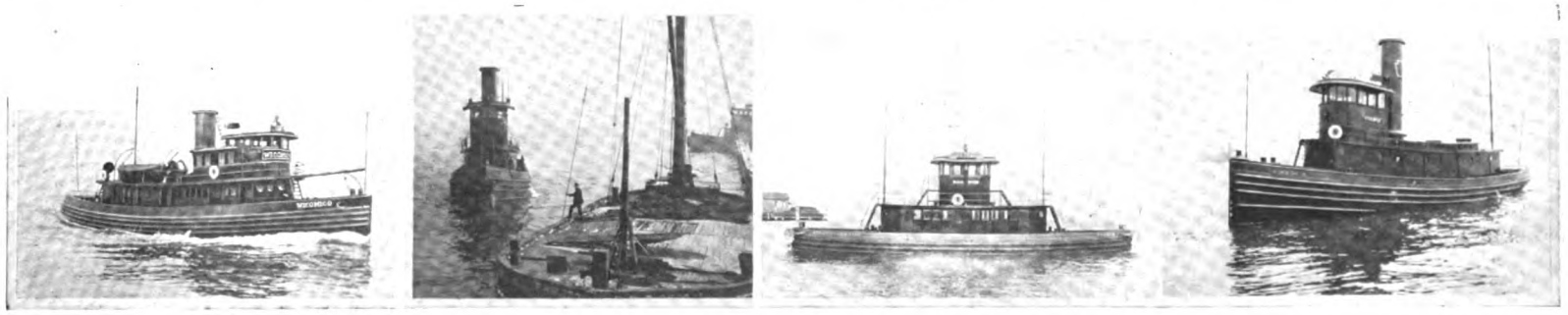
In these Diesel-electric towboats there are two main generating sets, supplying together at full load the maximum power for which the tugs are designed. During the greater part of the day their service calls only for reduced power, and therefore only a slight diminution of their total daily work is recorded when one engine is entirely cut out. This feature helps to reduce the cost of maintenance by saving the time of the boat and crew during the maintenance work, also by the convenience it affords in the organization of routine inspection and replacements.

Shore engineers can be scheduled to go aboard at regular, extended intervals to look over first one engine and then the other, keying up and making adjustments, while the boats are in service with the regular engineers attending to the operation of one engine. For repairs a similar course is followed, the boat being kept in commission with one engine active, while the shore engineers are aboard putting the engine in good order.

Such intensity of operation can be attained only with electric tugs deriving their power from a Diesel oil-engine plant. Compared with coal-fired steam tugs one hour is saved each day because no time is taken up for coaling, watering or discharge of ashes. Compared with an oil-fired steam tug 20 min. a day are saved because there is no watering, and an

24 Hours Per Day
Seven Days a Week

CHECKED by an executive official of these towboat owners, this article indicates how the entire capital investment for new Diesel-electric tugs will be wiped out in about 10 years by the big savings affected. The savings are actually greater than shown in the article, where the figures do not take account of the avoidance of such damages as occur with the comparatively ineffective maneuvering of steam tugs, etc. Towboat-owners who now have small fortunes tied up in money-burning steam-tugs should carefully study this article, based on the experience of the very capable engineering staff of a company operating the new type of tug as well as the old.



Diesel electric tugs of the P. R. R. fleet which in the course of a year can be kept at work a greater number of hours than any other class of towboat

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additional gain of some hours per month is made because of less frequent fueling. In comparison with all types of tugs, including the direct-drive and geared oil-engined tugs, the electric towboat further saves the total time of inspection, overhaul and repairs.

In the course of a calendar year the Diesel-electric tug can thus be kept at work a greater number of hours than any other type of towboat. The operating records of these tugs demonstrate this gain. A conservative measure of it requires, however, the averaging of the performance of all the boats over at least a full year's continuous service, and it will be some time yet before this can be done. In a case of this sort it is better to await the observed figures than to give estimates liable to revision.

This gain of operating hours is distinctive and apart from the gain due to increased working time per day. The former represents the diminution of lay-off periods for boiler washing and machinery maintenance or repairs; the latter represents the elimination of such daily servicing as coaling, watering or ash discharging. The first is an exclusive benefit of electric operation; the second is derived from the use of oil engine power in place of steam.

For a true comparison of the labor and fuel costs of the different types of tugs the daily, weekly or monthly totals should therefore be adjusted in accordance with the percentage of effective working hours. The steam tug loses more time than the straight Diesel-engined tug, and the straight Diesel-engined tug loses more time than the Diesel-electric tug.

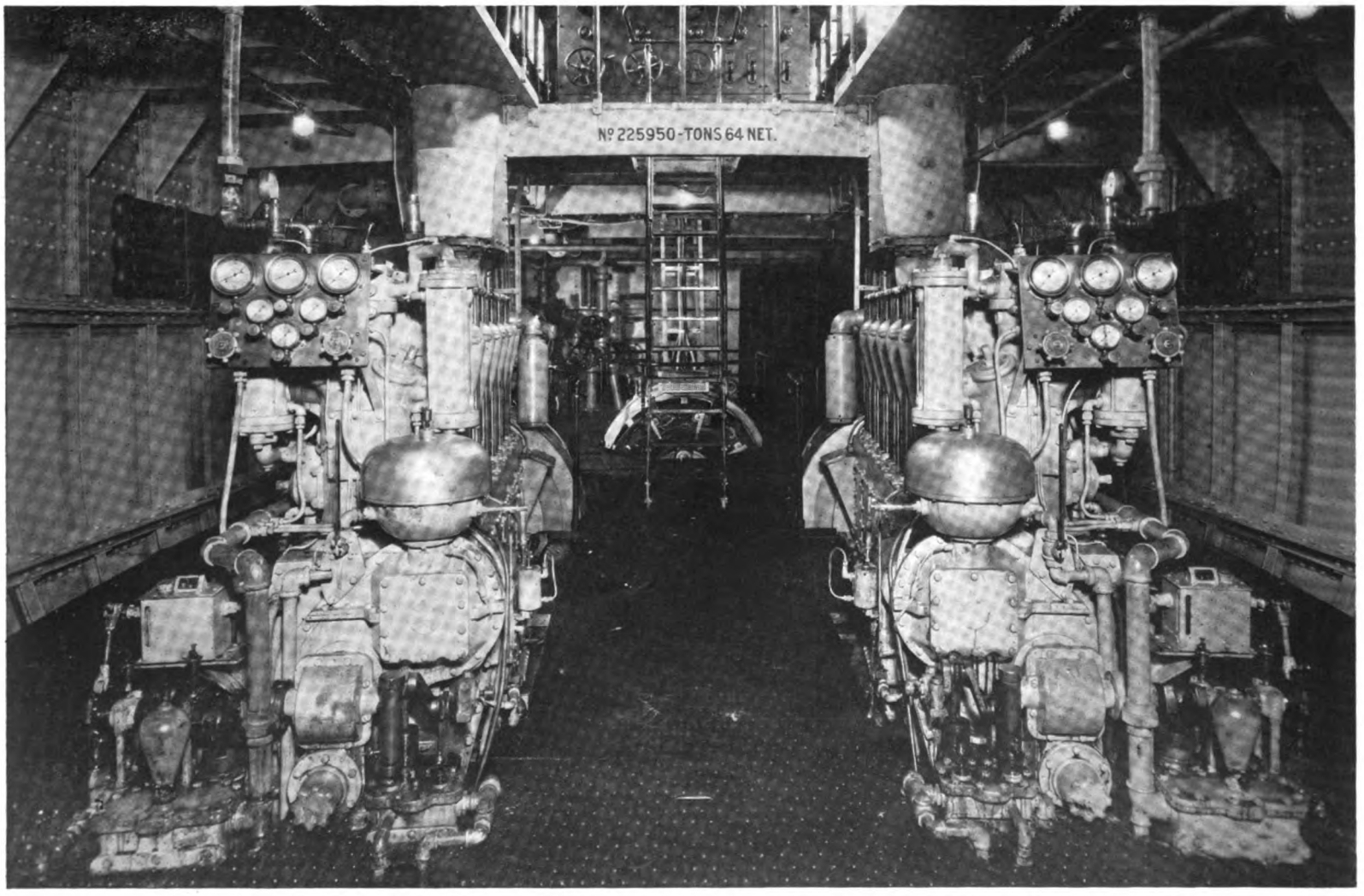
A still further gain of time is made through the superior maneuverability of the electric drive boat. This gain is clearly apparent in every detail of the consideration of the manifold advantages of the electric maneuvering, but it is difficult to equate. In fact the financial value of many of the benefits of electric operation, though visibly existent, baffles appraisal, either because it is mixed up in general accounts or is interwoven with other factors. A commercial organization cannot resolve itself into a bureau of economic research. The net reduction of operating costs is the end that is sought, and the items are not broken down to their last elements.

Superior maneuverability was one of the major factors in the decision of this owner to adopt the electric drive. For years previously the management had considered every device offered for pilot-house control of steam tugs and encouraged every effort to develop such a contrivance, but had found nothing suitable. It was an evident way to reduce the hazard of the human element in the maneuvering of a boat.

When every control movement has to be registered through the mind of the engineer as well as through the mind of the pilot, which is the case when bells or telegraph are used to send orders down from the pilot-house to the engine room, it is obvious the hazard of a wrong movement is doubly as great as with pilot house control which requires a change of power to register through only one mind, namely the pilot's mind. There are no ifs and buts about it. Just twice as many opportunities for error are presented by the old system as by the new.

When it is remembered that a railroad tug in New York harbor service, snaking carfloats in and out of the slips, probably records as many power control movements in a month as an ocean vessel makes during her entire life, the increased chances of damage to the tug or to other boats in the slip become very plain. The reduction of the hazard due to the human element is therefore seen as a very desirable accomplishment.

Actually, these Diesel-electric tugs have proved the point being noticeably less involved in damages than the steam tugs are. It is doubtful that the moral influence on the pilot of the knowledge that the responsibility is indivisibly fixed in him has been a factor in this achievement. The steam tug pilots are just as careful and the steam engineers are as reliable as can be, but between them they double the chances of error. The pilot may subconsciously give a signal other than the one he has intended to give, or the engineer may subconsciously do something different to the order. Cut out the duplication, and the hazard is halved. Furthermore, in an emergency there is no delay in having an order executed, because the pilot reaches for the controller and immediately gets the response he needs. The importance of two seconds delay in an emergency is more easily appreciated when one realizes that a tow moving at five miles an hour travels 15 ft.



Free access to every part of the mechanical equipment is an important characteristic of the Diesel electric installation. This view shows the Winton Diesel and Westinghouse electrical installation in P. R. R. No. 15

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in two seconds, and 1 ft. is quite a margin for boats working in and out of a slip.

It has been the experience of this owner that the pilot-house control is mastered very quickly by the pilots. Half a day generally suffices to break in a steam-tug pilot. Neither the pilots nor engineers are selected for the Diesel-elctric tugs. They make application for the positions and are posted to them under the seniority rule. No distinctive trait has been observed in the pilots qualifying for these boats, but amongst the engineers it has been noticed that the brawnier the man the closer he holds to steam and the brainier the man the more eager he is to be on an electric drive tug. This suits very well all round.

With pilot-house control and the responsiveness of the electric motor to fine regulation, the pilots are developing a new and improved technique. They can take up the tow more surely and quickly; they can handle it more positively under all conditions; and they can berth it with greater precision. For instance, a steam tug in backing out of a slip with a carfloat—which displaces, say, 1000 tons—, will have a deckhand easing the bow line round the niggerhead in order to prevent the line parting under the strain when the engineer cracks the throttle open, will similarly require the stern line to be eased off when the strain is transferred to it by the first ahead movement, and will not have her breast line made fast until the deckhand has finished easing the other lines.

A great contrast is presented by the electric drive tug, which makes all three lines fast at the beginning, because the pilot can take up the strain on the rope so smoothly and gradually that there is no risk of parting it. He is enabled to do this because the first notch on the controller turns the propeller at no more than 8 or 9 revolutions a minute—i.e. 7 or 8 seconds for each revolution! He can instantaneously reduce power if he notices the strain becoming too great. No steam engine can turn as slowly as this, and a direct drive, or geared, oil engine is far from it.

Electric power is incomparable in this respect. On each job a little time is saved because the pilot does not have to wait for the deckhand to leave the bow line before the stern line can be made fast or vice-versa, and the delays and hazards of a parted line are eliminated. In the course of a day the multiplicity of those little savings of time accumulate and help to swell the record of the work done.

An example of the superior handiness of the electric system when a tow is under way is furnished by comparing its action with that of any other type of tug when the speed has to be checked. The carfloat or barges alongside naturally swing off when the way is checked, their tendency being to pivot round the tug. Helm alone cannot overcome this swing, but helm and power together applied to a nicety can correct it. The pilot of a steam tug has not a fine enough control to do it, but the pilot of the Diesel-electric tug can keep his tow headed right up, and there are times when that is exceedingly useful.

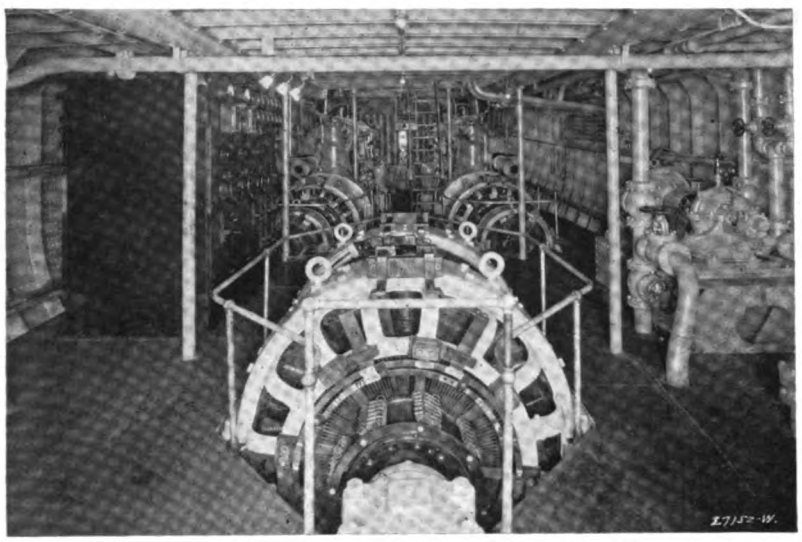
In berthing a tow the exact control of speed at every instant gives the pilot of the electric drive boat a considerable advantage. Slips are narrow, congested and have to be entered across the tide, and the carfloats that have to be berthed in them are as long as 300 ft. A paper read in New York before the Society of Naval Architects and Marine Engineers in 1924 stated that the average towing operation of the P.R.R. Marine Department in New York harbor could be divided approximately into three equal periods, viz. making up, towing and delivery respectively. Berthing a tow in its slip is thus seen to constitute about one-third of the total transfer work performed by a P.R.R. tug, and because this largely arises from the slip congestion the benefit of the quicker and more exact electric control is not difficult to understand.

It is in the confined spaces of the slips that losses arise from damage done to floating equipment. When tides run as fast as three miles an hour across the mouths of slips that are seldom more than 250 ft. wide and which may contain at one time two carfloats in line on each side and maybe a lighter breasted off, the skill required to cut out a carfloat for transfer and berth another in her place without crashing the piers or any of the boats can be to some extent visualized. Every aid that can be given to the pilot in the way of improved control helps to improve the service and reduce the cost of operating under these conditions.

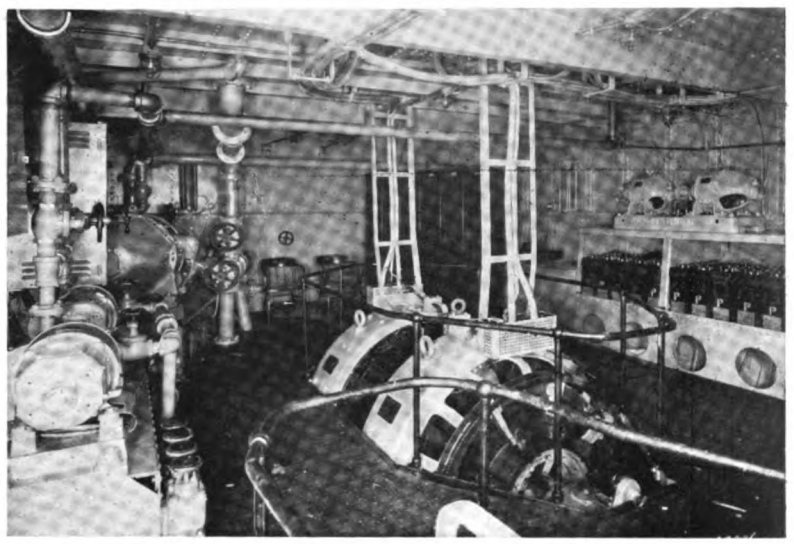
The pilot-house control, with the fine regulation of speed and smoothness of the electric drive represent very real improvements in towboat practice. They are not mere refinements of equipment, but absolute factors in speeding operations and cutting costs. How they speed up the work has been instanced by specific examples; how they have reduced damages to floating equipment and thereby reduced the insurance burden has been explained. It may be added here that the improvement in starting the tows is not confined to a gain of time only, but is actually saving a big sum in the cost of rope. The Diesel-electric tugs are estimated to be using only 50 per cent of the rope used by the steam tugs, an economy which will prove considerable in the course of a year at the rate the railroad tugs use up lines in the intensive service at the slips.

Every railroad tug mixes its straight towing operations with intervals of operation at the slips. The tugs are under the orders of a dispatcher, who arranges for the transfer of carfloats and lighters with as little lost motion and as little waste time as possible. Tugs waiting for assignments are not idle, but are employed in shifting the equipment as may be necessary at the different slips. For this reason the daily operations of a towboat cannot be measured in ton-miles or any other common standard, but are entered on the daily report in terms of carfloat transfers and slip jobs. To the marine department of a railroad these entries present a clear meaning, being a very effective measure of the work accomplished, but to anybody else the entries are mere jargon. That the Diesel-electric tugs are doing more work per day is evidenced in these daily reports, and it is a pity there is no easy way of interpreting them in terms that would be generally understood.

Two of these electric drive tugs are, however, engaged in a restricted operation, from which they have displaced three steam tugs. Their performance is therefore at least 33 per cent better than that of the old type boats. Possibly it is better than 33 per cent, because the two Diesel-electric tugs with one steam tug are excelling the showing of the four steam tugs previ-



Half power of the electric tug is obtained at the highest efficiency of one engine: Wicomico engine room looking forward



Fine regulation of speed and smoothness of electric drive are real improvements: view of P. R. R. No. 15 engine room looking aft

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ously employed. As the single steam tug still used in combination with the two electrics cannot have improved, the deduction is that the two new-style boats are not only doing the work of the three steam tugs they displaced, but are also helping to do some of the work formerly done by the fourth.

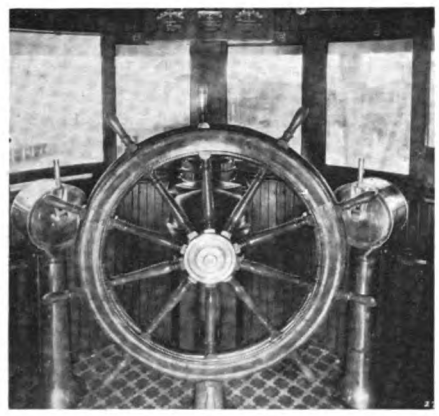
These two particular boats are known as drill tugs in the Pennsylvania Railroad service. They are double-ended and have been developed for a special operation, namely the shifting of barges in the four long slips where the cars are transferred to and from the floats before distribution, or after collection, in the harbor. The steam tugs used to spend a lot of time finding room to turn around. It is essential to have the tug headed in the direction in which the carfloat is to be moved, because the space is very confined and the maximum maneuverability therefore needed. Often a steam tug would have to go the whole length of the slip before being able to turn and then perhaps would have to back up just as far to take hold of the float. This involved a loss of time.

In fact, a series of time observations were taken, and an analysis of them pointed to the serious loss arising from this waste motion. The double-ended type of tug was proposed to eliminate the necessity of turning, but this could not be satisfactorily worked out with steam. When the electric drive came up, its suitability for the purpose was obvious, the propelling motor being separate from the power generating unit. Two double-ended Diesel-electric boats were ordered which, so far as general information goes, are the first double-ended tugs ever built and certainly the first electric tugs of that type. They afford a striking example of the value of imagination applied to the solution of problems of operation.

The two Diesel-electric drill boats are neither large nor powerful. They do not have to be, for they operate always in still water, have no tides to buck and move only short distances. They are fitted with an electric motor of 250 s.hp. operating a continuous shaft with a propeller on each end and the power is supplied from two oil engined generator sets. No steam tug could respond to bells as fast as the power changes are made on these boats. Full power is seldom carried for as long as 2 or 3 minutes continuously. At rare intervals a period of 5 minutes of full power occurs, due perhaps to a transfer from one slip to another. This characteristic of the operations permitted the selection of relatively high speed engines for the generator sets. The Diesels turn at 450 r.p.m. and no disadvantage has been encountered therefrom.

These two drill tugs, though entirely a new development, have been extremely successful. If their work were only a little more concentrated there is no doubt they could dispense with the aid of the steam tug still retained and perform all the work of the four steam tugs previously employed. They are kept in service 24 hours each day and are maintained in good order without ever being laid off, except for bottom cleaning and painting.

The larger Diesel-electric tugs, P.R.R. No. 16, P.R.R. No. 18 and P.R.R. No. 26 are classed as transfer tugs, their chief duty being to transfer carfloats and barges between the railroad terminal and other piers in New York harbor. They also transfer lighters from point to point. The Pennsylvania services in the harbor are largely concentrated, and the conditions of operation are found to be most economically met by transfer tugs of 575 s.hp. capable of making 6 miles per hour at full power with one carfloat or 4 miles per hour at half power with the same load. Because only one-third of the total time occupied in a complete towing operation is spent in the pier-to-pier run and most of the distances



Pilot house control is mastered quickly by the pilot

are short, the value of the time to be gained by running at full power instead of at half power is more than offset by the doubling of the fuel cost.

In the Diesel-electric transfer tugs the power plant is subdivided into two generating units. A part of the time therefore the tug requires only one engine to be kept in operation, and this features greatly facilitates the engine maintenance method explained earlier in the article. Occasionally a tug will make up a heavy tow of barges requiring full power on a longer run, but this occurs only when there are several barges for the same destination.

Under the particular conditions of the Pennsylvania Railroad's marine operations in New York harbor the use of the subdivided power plant produces an extra economy through the fact that half power of the electric tug is obtained at the highest efficiency of one engine. The steam tugs at half power are way off from their highest efficiency.

Small wonder that the electric transfer tugs are estimated to be cutting 20 per cent off the cost of operation prevailing with the steam tugs. This estimate is conservative. When all the advantage of the electric drive tugs come to be measured in dollars and cents on the books the economies are likely to prove greater than this estimate.

A greater capital investment is represented in the Diesel-electric boats. They cost about 20 per cent more to build. On first thoughts it might appear that the operating savings, which are, say, 20 per cent in the case of the transfer tugs and not less than 33 per cent in the case of the drill tugs, only just about compensate for the higher cost. When expressed in terms of money the true gain is much clearer. At the date when the Diesel-electric transfer tugs Nos. 18 and 26 were ordered, the cost of new steam tugs of the same power would have been about $150,000 each, while the electric drive boats cost about $180,000 each. The operating savings of each electric transfer tug in the course of a year, it is estimated, will prove to be not less than about $14,000, which is sufficient to wipe out the extra capital investment in several years and then leave the big annual saving as a net operating gain.

The transfer tug P.R.R. No. 16 was the first Diesel-electric towboat ever ordered, it was the first one built and it was the first one placed in service. The order was placed in 1923, and the boat was commissioned in the spring of 1924. A certain amount of development was of course demanded, but when four more Diesel-electric tugs were ordered in 1926 there was no longer any question about the magnitude of the operating economies that could be made. The three large electric drive tugs and the two smaller ones now serving this railroad in New York harbor are together responsible for a very considerable saving in operating costs.

The three transfer tugs, P.R.R. No. 16, P.R.R. No. 18 and P.R.R. No. 26 have a registered length of 99 ft., breadth 24 ft., depth 10.6 ft. and tonnage of 186 gross, with an electric motor of 575 s.hp. The two drill tugs, P.R.R. No. 15 and P.R.R. No. 20, have a registered length of 69 ft. breadth 19 ft. depth 9.5 ft. and tonnage of 95 gross, with an electric motor of 250 s.hp. at each end. All five have Winton Diesel engines Westinghouse electric equipment throughout. Two more Diesel-electric transfer tugs of the same size and power are now on order, one being for a subsidary company, which already has one in service. These will make a total fleet of eight boats.

New Chief Engineer for Cutler-Hammer

Appointment of Mr. N. L. Mortensen as chief engineer for The Cutler-Hammer Mfg. Co., Milwaukee, has been announced effective September 1st. Mr. T. E. Barnum, former chief engineer, has been appointed consulting engineer for the Company, in which position he will be able to give uninterrupted attention to engineering problems and outside engineering relations.

Mr. Mortenson has been connected with Cutler-Hammer for 21 years, the last five of which have been as assistant to Mr. Barnum. Born in Denmark and receiving his technical education there, and in Germany, Mr. Mortenson's versatility as a control engineer has long been recognized by United States industry. Articles by him have appeared frequently in the technical press and he has delivered numerous papers before electrical societies. He is a fellow of the A.I.E.E. and a member of the A. I. S. E. E. Mr. Mortenson assumes his new post with the best wishes of his host of friends and all the industry in general.

Pacific Diesel Engine Plant Sold

The Atlas Imperial Diesel Engine Company, Oakland, Cal., has purchased for $405,000, the Pacific Diesel Engine Company of the same city. The sale was ordered by Federal Judge Kerrigan. It will be recalled that the Pacific Diesel Engine Company went into receivership May 15, 1926.

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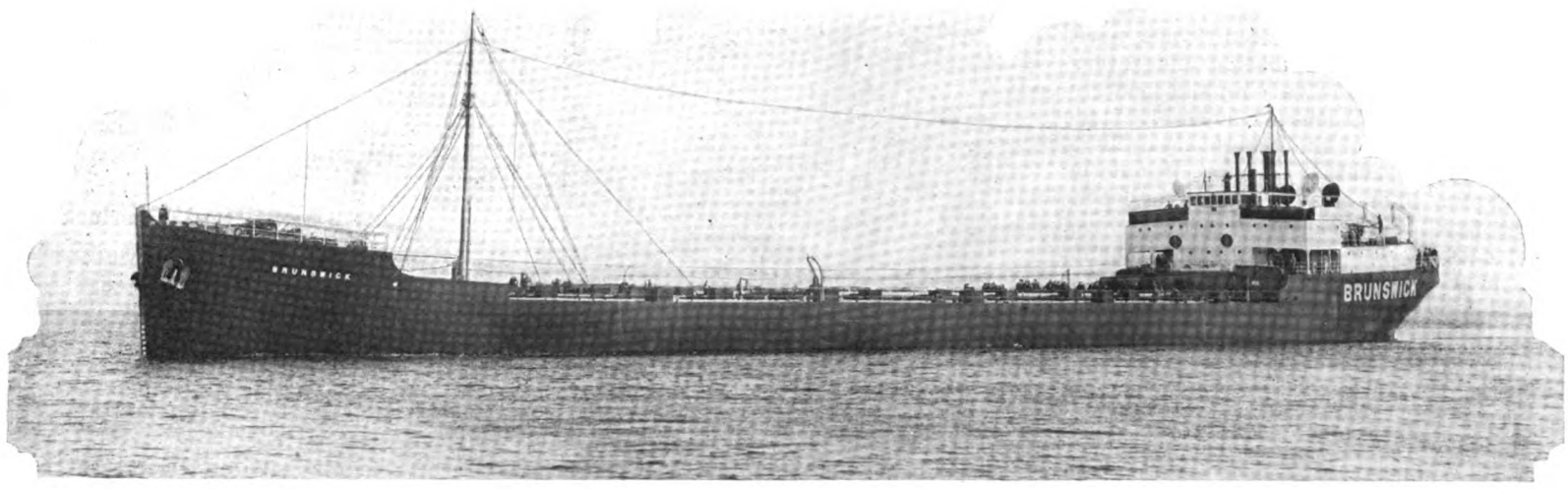


Fully loaded the Brunswick represents 17,680 *tons of ship, cargo and machinery under instant control from the pilot house*

Pilot-House Control of Big Tanker

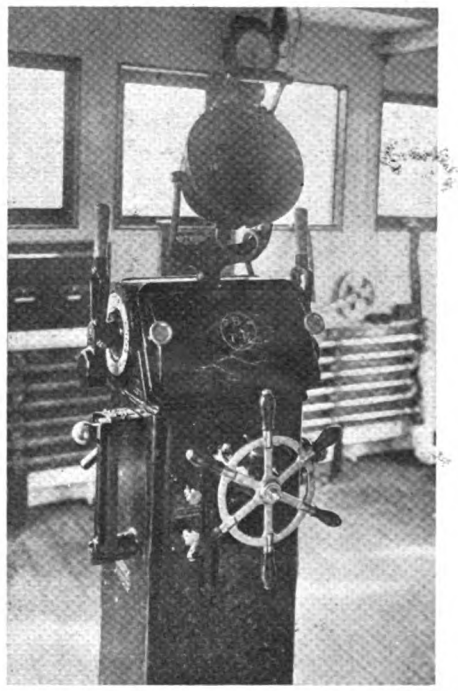
Both Helm and Propeller Respond Instantly to Deck Officer from Single Unit

THERE is little that is commonplace about the new Diesel electric tanker BRUNSWICK. She has the distinction of being at present the largest ship of her type in the world. Her owners, the Atlantic Refining Company of Philadelphia, are known to be very strong advocates of Diesel-electric drive and the BRUNSWICK is the ninth vessel of their fleet so equipped. This gives a background of valuable experience capable of being put to very practical and serviceable use.

The obvious advantages of pilot-house control are many and its less universal acceptance has not been because of non-belief in the theory. Heretofore there have been mechanical limitations governing the size of ship on which it can be employed successfully; electric drive eliminates such limitation and may be applied to ships of all sizes and powers.

A full conception of what the BRUNSWICK'S installation of machinery is capable of doing can only be gained by a careful study of it. At the same time we gain an impression of Alladin-like magic by a single glimpse of her pilot-house. A Sperry unit, little larger than the older type binnacle, automatically steers the ship; and that is not surprising, because we have come to accept it as an every day occurrence. Yet in this same unit the officer on watch has complete and instant control of the propeller. This device is comparable to a master-key; the brain, or nerve-center perhaps, of the entire system of intricate devices. A small lever that requires only the strength of a child to move it may be shifted from one position to another and so bring into play a series of forces which control the movement of some 17,680 tons of ship, machinery and cargo. This system amounts to a combination of "wheels within wheels" by means of which forces of magnetic and mechanical nature are multiplied and re-multiplied until the ship comes under the will of her master, docile and obedient to delicate touch.

The Sperry Gyroscope Company, installed the standard Mk. VIII. gyro compass



The master control steers and maneuvers the ship

equipment, complete with a steering and bearing repeater, in the BRUNSWICK. They also supplied a course recorder and a Sperry two-unit type of gyro pilot. The gyro pilot provides the sole method of steering-engine control, embodying two systems—hand-electric and fully automatic steering. The top cap of the bridge unit of the "pilot" also contains the propeller control. A Sperry helm angle indicator and two 18 in. incandescent searchlights with pilot-house mounting are also used.

Engines and Generators

To obtain the proper perspective we must view the equipment from the other end and to do it we must enter the engine room wherein lies the source of power. Four Ingersoll-Rand Diesels built by Carels Frères, Ghent, Belgium, running at 225 r.p.m. are direct-coupled to four 600 kw, d.c. generators which supply current at 250 volts. Each engine also drives an auxiliary generator of 75 kw, 250 volts, arranged in tandem with the main generator. These generators supply power for the ship's auxiliaries and also for excitation of the main generators and the propelling motor. The main generators are electrically coupled in series, and although all four are normally in operation at full power, three, two or only one set may be used for reduced power; the combined voltages being 1000, 750, 500 and 250, according to the number of sets on the propelling circuits.

The main propelling motor is rated 2800 s.hp. at 95 r.p.m. It comprises two units, each complete with a separate magnet frame, armature and commutator. The two armatures are electrically connected in series and mounted on a common shaft supported between two pedestal bearings. Since the propeller motor consists virtually of two motors in series it is possible to develop power for about three-quarter speed with only one half of the motor in commission. All the propelling generator and motor fields are separately excited from one of the auxiliary generators. Starting, stopping and reversing of the propeller

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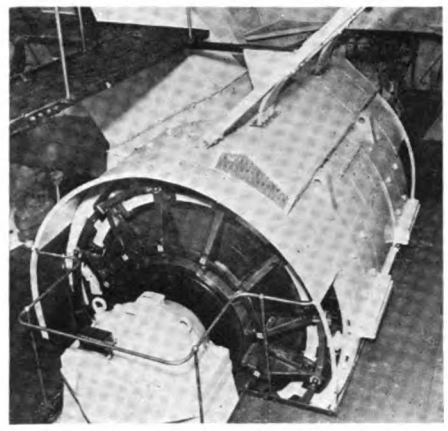
motor are effected entirely by varying the excitation of the main generators or generator as the case may be.

Electrical Control Arrangements

The main propelling circuits are never interrupted and all regulation and reversing is carried out by varying the field circuits only. Provision is, however, made for isolating any of the generating units as desired. The control is carried out by means of a liner attached to a small controller fixed to the front of a sheet steel panel carrying the necessary instruments. Movement of this lever, on either side of a central stop point, to the speed point required, either ahead or astern, is all that is necessary in maneuvering.

The actual varying of the propelling generator fields during maneuvering is effected by means of a reversing potentiometer rheostat common to each generator field circuit. The rheostat is operated through gearing by a small electric motor. Movement of the control lever switches this small motor into circuit. By means of follow-up gear, the small motor switches itself out. It stops when it has moved the field rheostat to a position where the field strength on the generator corresponds to the speed point where the lever is at rest on the controller. The speed at which the potentiometer rheostat increases the voltage on the generator is



2800 *s.hp. in a compact electrical propelling unit*

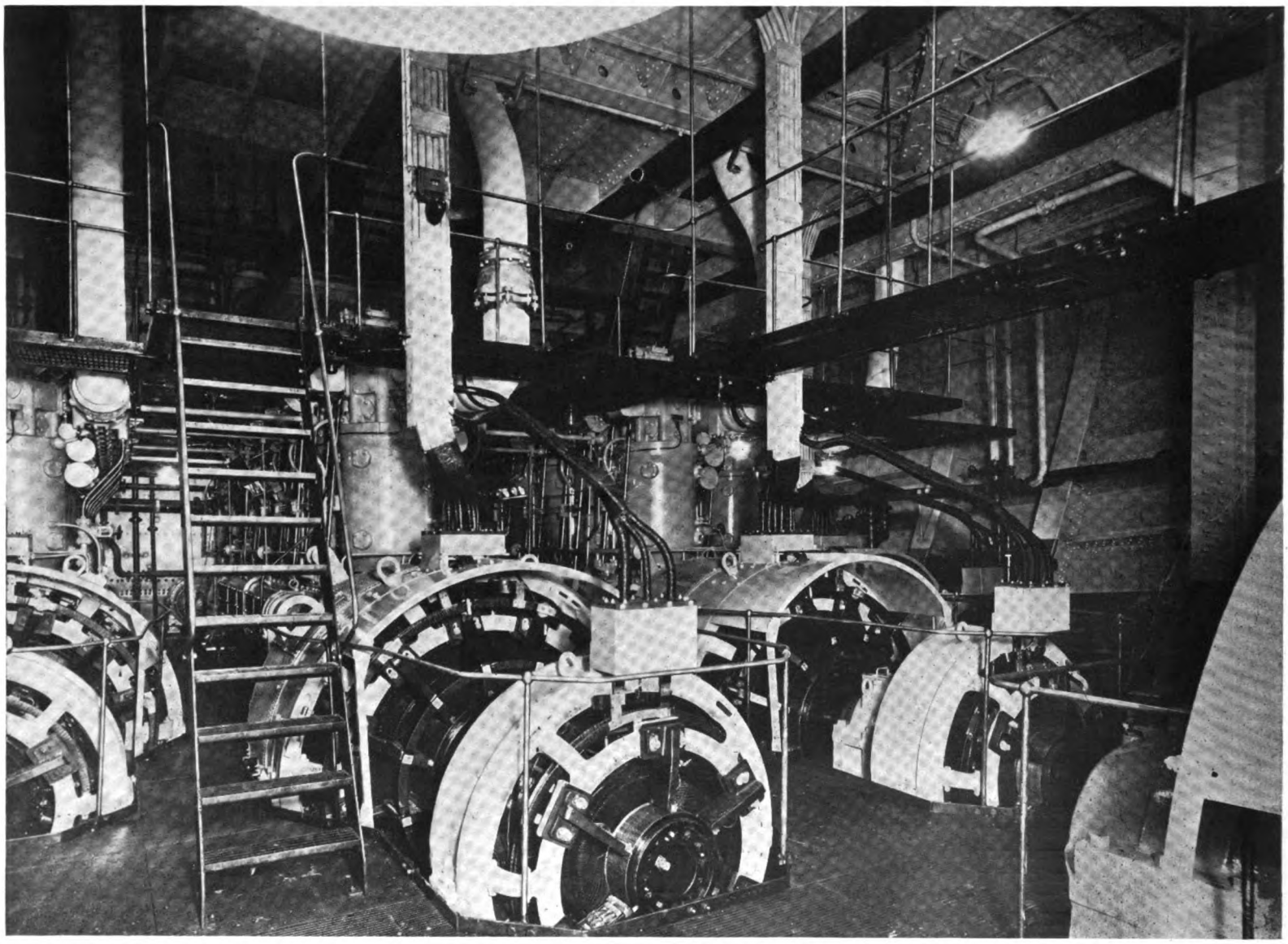
such that under normal conditions the power required to accelerate the ship does not exceed the full load capacity of the engines. This is taken care of automatically by the follow-up gear regardless of the speed with which the controller on the bridge is operated. There is also a special type of overload current relay in the main circuit.

Main circuit breakers or main power interrupting devices are not provided in the propelling circuit, as under abnormal conditions it is considered preferable on plants of this description to leave the stressing of the equipment entirely to the discretion of the engineer on duty. The motor is on a circuit entirely different from the usual power circuit on land. Since the propeller motor is equal in capacity to the generating plant, it is not so liable to prolonged overloads. Normally the propelling system is connected through a circuit breaker and current limiting resistance to the ship's structure at the point between the two motor armatures. Should an accidental ground occur on any part of the main circuit, sufficient to open this circuit breaker, a loud ringing bell in the engine room gives warning.

Quick Change and Interlock

An important feature of the equipment is the simple manner in which a generating set can be put into or taken out of service without stopping the propeller motor. If the set to be shut down is supplying the excitation, the operator can transfer the excitation to another auxiliary generator without leaving his post at the control panel, by merely turning a hand-wheel.

A protected type of switch panel, carrying four operating handles and suitable interlocking gear, enables a generator to be put in the propelling circuit or taken out without damage by careless switching. These panels also allow any one of the propelling generators to be used for the auxiliary load. In the event of failure of excitation current the main potentiometer rheostat returns automatically to the "stop" point. This recloses the field contactors, resets the overload relay (if tripped) and



A spacious engine-room, giving the accessibility so essential to successful operation, is made possible by using small powerful units

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returns automatically to the previous setting, according to the position of the bridge controller, as soon as voltage is resumed.

To provide against failure of the small rheostat motor when the vessel is being maneuvered, a hand-wheel mounted on the motor panel enables the potentiometer rheostat to be manually operated. This hand-wheel is normally disengaged from the rheostat operating shaft. It is always ready for instant engagement should the propeller speed fail to respond to a movement of the control lever. When engaged, it automatically cuts the small rheostat motor out of circuit. The control lever is arranged to allow a complete full power reversal in about eight seconds. The effort required to do this manually is too great to allow it to be done in this time. Therefore, the hand-wheel is geared so it can be operated through a full power reversal in about 30 seconds.

Braking with the Engines

When bringing the propeller to rest, prior to a reversal, the power returned to the electrical system due to the action of the water causing the propeller to keep rotating in forward direction (and consequently to drive the propeller motor as a generator) is dissipated in "motoring" the propelling generators. These in turn partially or entirely supply the motive power to rotate the engines and auxiliary generators. Due to the considerable amount of power required to overcome the friction load of a Diesel engine at full speed (between 20 and 25 per cent of its normal output on engines of this size) this forms a very convenient means of dissipating the braking energy.

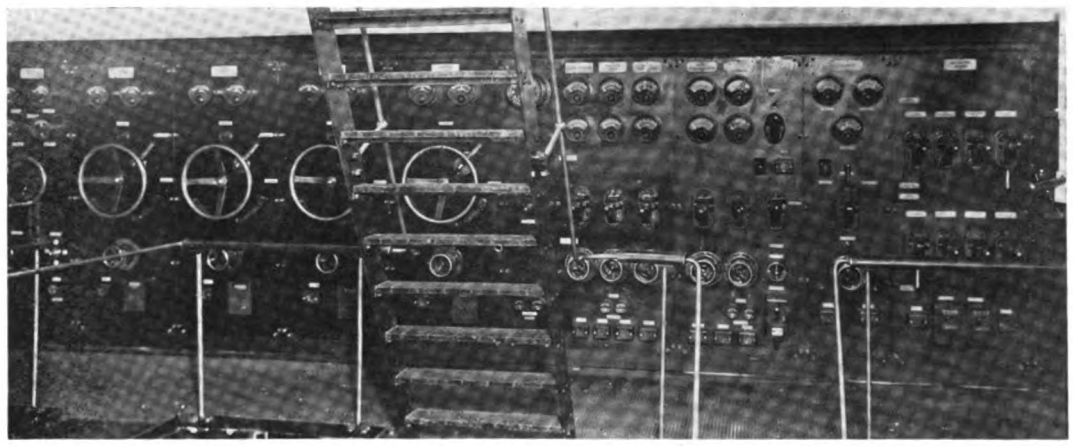
A feature of the electrical installation is the dead front type main switch-board. It has an overall length of 30 ft., and consists of 11 panels. These panels include one propeller motor panel, four generator panels, each with "set-up" switches which can be mechanically operated from the front of the board. The "set-up" switches are arranged to give three positions, namely, *off, propulsion circuit* and *main power busbars*. There are four exciter panels of the dead front type. The exciter switch arrangements are such that they are mechanically interlocked to prevent paralleling the exciter, and electrically interlocked to prevent paralleling an exciter with the main generators.

One balancer panel of the dead front type is installed so as to permit operation of the balancer from either the exciter circuit or from the auxiliary generator exciter. One distribution panel for the auxiliary circuits is arranged so that it is possible to supply all auxiliaries from either the exciter busbars or main power busbars.

Complete metering equipments are provided on all panels and the entire switchboard has ground detector voltmeters and detector lights. Current detection apparatus is connected for each set of busbars and for each generator, motor, excitation, balancer circuit, etc.

Excitation and a Stand-By

The four main generators are connected in series and "set-up" switches on the main switchboard enables one, two, three or four generators to be used. The auxiliary generators, or exciters, are self-excited. As previously stated they are used to supply excitation to the propeller motor and main generators and to run the auxiliary plant. Since they are not paralleled each one supplies an independent circuit. Any three can be used for the purposes mentioned at the same time while the fourth remains a stand-by.



Simple in the extreme is the arrangement of this dead front type main switchboard

Current from the exciters is utilized to energize potential or voltage relays which trip out contactors in the field circuits of the main generators, when the latter are on "propulsion," so as to prevent the remaining generators from "motoring" an engine in the reverse direction should the engine stop. Excitation, auxiliary and main power busbars are provided for auxiliary purposes, and interlocks prevent more than one generator at a time being connected to the same set of busbars.

The main generator "set-up" switches are mechanically interlocked to prevent live switching. A lever, which takes the field off a generator, must be moved to the off position before the main switch can operate. These "set-up" switches are also mechanically interlocked to prevent more than one generator being connected to the main-power busbars.

A busbar connecting switch connects the auxiliary busbars to the excitation busbars for use when only one engine is running. Mechanical interlocks prevent any other exciter being closed on to the auxilary busbars when this switch is closed. The exciter switches are interlocked to prevent more than one at a time being closed on to the same busbars.

The equipment of the electrically-driven auxiliary machinery on the vessel is carried out on a very extensive scale. All engine room auxiliaries and deck machinery, including pumps, fans, compressors, winches, and other machinery are electrically driven. All the motor starters are mounted on two auxiliary panels. The voltage of the power circuits is 250, while for lighting purposes a balancer set, 250 to 125 volts, is provided. The electrical equipment for this vessel was designed by the British Thomson-Houston Co.

Auxiliaries

Interest in the mechanical equipment does not cease with the arrangement just described. All engine room auxiliaries and deck machinery, including pumps, fans, compressors, winches, etc., are electrically driven. The total horse-power of the auxiliary motors is 550 and the size of the individual motors ranges from 1 to 80 hp. All the motor starters are mounted on two auxiliary panels, the motors being generally controlled by a convenient push-buttom.

Engine room auxiliaries are comparatively few in number and small. All pumps are of centrifugal or rotary type. Three pumps, two of which are required at full power, provide cooling water for the main engines. One of them used as a fire pump has a motor of larger power than the others.

A vertical multi-tubular boiler, with a heating surface of 630 sq. ft., supplies steam for heating the quarters, and carries a working pressure of 25 lbs. per sq. in. Arrangements are made to utilize the exhaust from either of the two center main engines, in addition to an oil burner for use in port when the main engines are not running. An Ingersoll-Rand type 2-cylinder auxiliary Diesel direct connected to a 25 kw. generator is provided for lighting and auxiliary power purposes in port.

The starting air at 250 lbs. per sq. in. for both main and auxiliary engines is carried in two main tanks and supplied by two Ingersoll-Rand motor driven compressors. Two small tanks for the auxiliary engine may be pumped up with a small Reavell hand operated compressor which provides an emergency means of starting the auxiliary engine. Since maneuvering with the engines is not necessary, the air storage capacity and the air compressors are very small compared with the usual marine Diesel installation.

In addition to the auxiliary machinery mentioned above, pumps are provided for bilge and ballast, sanitary, fresh water, and boiler feeding duties. Two rotary pumps are used to transfer fuel oil to daily fuel supply tanks, one for each engine.

De Laval centrifugal purifiers are used for the main and auxiliary engine lubricating oil and fuel systems. Each of these has its own filling and delivery pumps driven from the machine spindle.

In an engineers' workshop on the main deck, over the engine room are a 7½ in. lathe with all-geared head and quick-change gears, a 20 in. shaper, a 20 in. radial drill and a double wheel tool grinder. The machines are driven by a five hp. electric motor. The refrigerating plant, of NH3 type, is also on main deck over engine room.

The steering gear with a motor driven Hele-Shaw pump operates with a pair of opposed hydraulic rams and is controlled from the bridge either by a small hand-wheel or automatically by the Metal-Mike.

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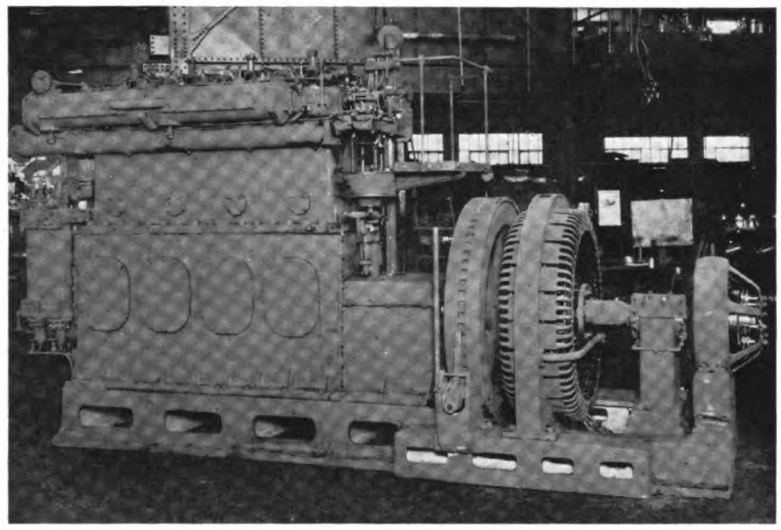
Diesel Power for Flood Control

Modern Machinery to Replace Manual Labor in Mississippi Revetment Work

FOLLOWING the appropriation for flood control work on the Mississippi the Mississippi River Commission have purchased a 225 b.hp. Busch Sulzer Diesel for installation in a concrete mixing barge. The engine will be direct connected to a 3 phase 60 cycle, 480 volt, a.c. General Electric Generator, all mounted on a common sub-base.

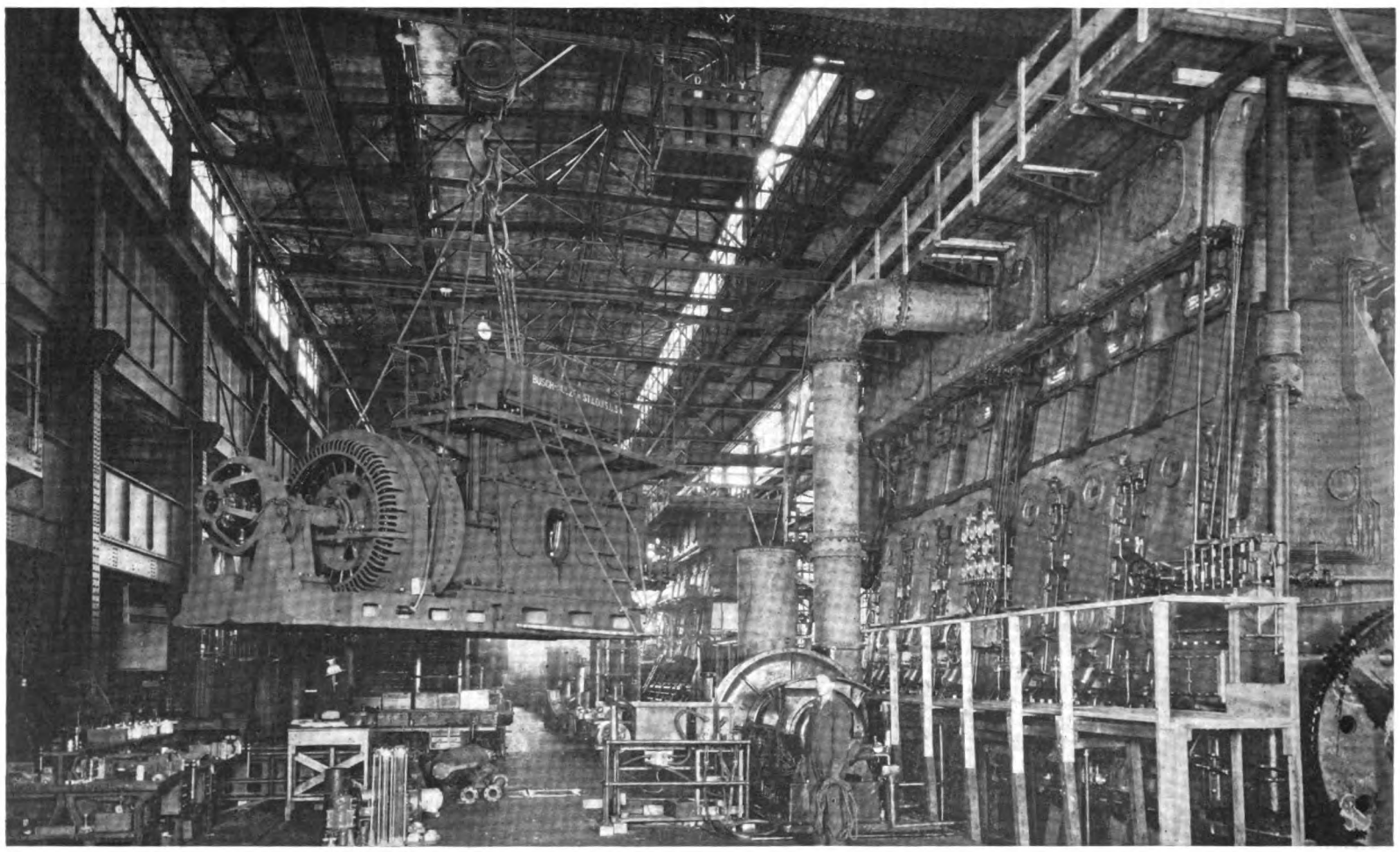
The introduction of Diesel power for this work marks an economic advance in solving the problem of national flood control. With the old methods there was evidence on every hand of lack of modern and up-to-date machinery. Flood-bands of negroes wielding tools filled bags with earth for revetment purposes and carried them to the points where needed to keep the Mississippi river in its bed during flood periods. With present methods concrete is used in place of the earthworks. It is prepared on barges where reinforcement of the river bank is needed. Made in sections and tied together by steel cables, it gives permanent and effective results.

The new Diesel powered barge to be used for this purpose is being rushed to completion. So urgent was the need of it that the Diesel-electric generating unit was purchased under contract providing penalty for delay in delivery. The successful bidder promised delivery in 50 days, including electrical test of the complete unit at St. Louis; shipment was made in 43 days after award of contract. One of the accompanying views shows the unit, complete and ready for shipment, suspended from a crane as it is being transported from the test bed to a railroad car at the end of the shop.



Built and tested complete in seven days less than the fifty days specified in the contract

Another view of this engine discloses a very neat appearance with a minimum of piping and gear. A substantial thrust bearing, intended for heavy marine service is fitted between the engine and flywheel. Providing exceptionally good overall rigidity, the cylinders are cast en bloc. Conforming to standard Busch Sulzer practice, air injection is used; the air compressor being directly driven from the main crankshaft. It is overhung from the crankcase and fitted with coolers of the straight tube type designed to afford easy access for inspection and cleaning. Also, following the builder's normal design, a continuous supply of lubricating oil is carried under pressure on the major bearings. Lubrication of the vertical shaft, thrust shaft, camshaft bearings, upper and lower helical gears and the outboard bearing is also supplied by the pressure system.



Busy days at the Busch Sulzer shops. A 3950 b.hp. Shipping Board Diesel at the right, a 3750 b.hp. stationary engine in the background and the engine for flood control work is suspended in the sling

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Big Fast Diesel Yacht Launched

Seaworthiness and Speed Characterize Splendid Vessel Being Completed at Bath

LAUNCHING of the big twin screw Diesel Yacht VANDA took place at the Bath Iron Works, October third. She is a vessel of striking appearance with straight stem, long overhanging stern and schooner rig. Her two pole masts will carry staysails and mainsails to steady her in heavy weather at sea. By reason of the VANDA'S size and the use of Diesel power her accommodation is exceptionally commodious.

Built of steel throughout to Lloyds class 100 A1 she is rendered safe against flooding in emergency by ten watertight transverse divisions. Six bulkheads extend to the weather-deck and four others extend to the lower deck; the latter, having watertight flats, form deep tanks for the storage of water and fuel oil. Additional storage of liquid supplies is provided in double-bottoms covering the entire bottom of the yacht not otherwise protected by deep tanks. Inter-compartment communication is obtained through watertight doors, with teltales in the pilot-house to indicate when they are closed.

All of the decks have steel beams, pillars and stringer plates, the main and forecastle decks being plated over entirely with steel. The deck houses, including the pilot house, are built of steel. The main deck and boat deck are planked over with teak.

Principal Characteristics of Vanda

Length o.a.	240 ft.
Length on waterline	219 ft. 9 in.
Beam	36 ft.
Depth to main deck	22 ft.
Depth to boat deck	30 ft.
Loaded draft (about)	15 ft.
Fresh water capacity	160 tons
Fuel capacity	347 tons
Cruising radius at cruising speed	20,000 miles
Cruising radius at full speed	7,500 miles
Estimated speed	18 knots

Main Propelling Engines

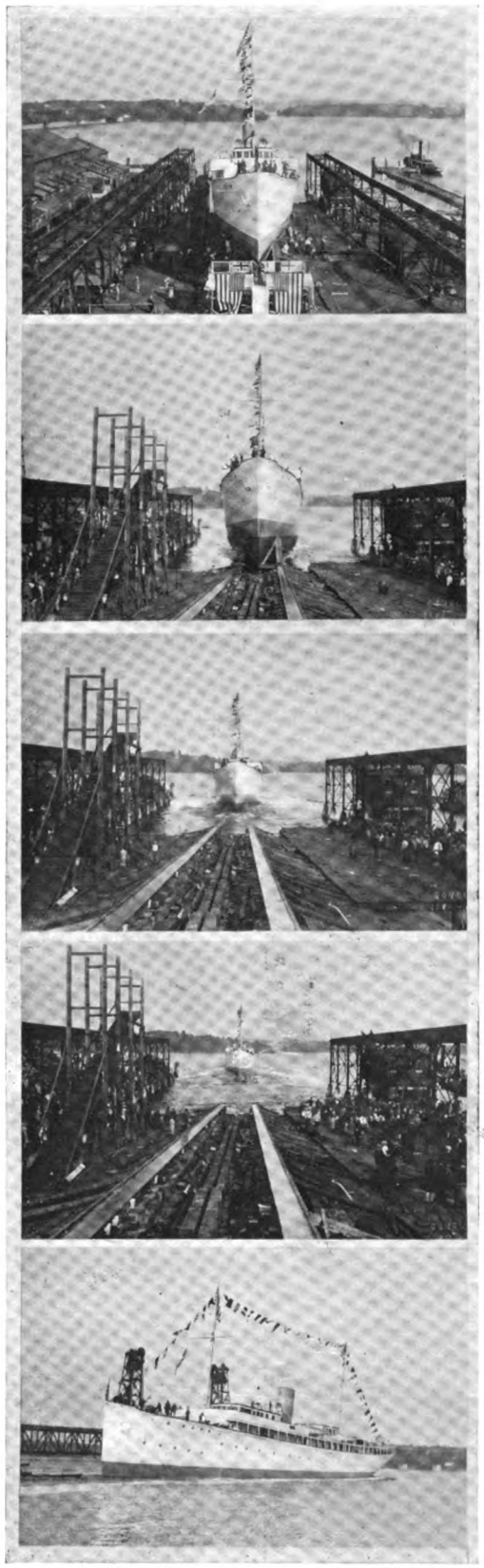
Two Bessemer Diesels; eight-cylinder, four-cycle, airless-injection, trunk-piston type.

Total power	3,000 b.hp.
Bore	18 in.
Stroke	22 in.
Engine speed	300 r.p.m.

Auxiliary power is supplied by two Bessemer Diesel driven generators of 60 kw capacity. The engine-room 56 ft. long contains in addition to the main and auxiliary Diesels a full set of electrically operated auxiliaries. These include pumps for general engine-room service as well as the conventional sanitary, fire and fresh water pumps. The refrigerating plant, oil purifiers, steering gear and thermo-fans are all electrically operated as well. Heating is accomplished with an oil fired boiler; the heat being distributed by means of air fanned over a bank of steam coils and through ducts to the quarters. In hot weather the same system is employed for cooling purposes.

The deck machinery includes a combination windlass and warping winch, double boat hoists, warping capstan and hydro-electric steering gear all made by Hyde.

Pilot-house and chart-room equipment includes, in addition to the conventional steering and navigating instruments, a radio direction finder, revolution indicators, draft gages and watertight door controls.



Less than a minute elapsed while the Vanda glided into the Kennebeck River

Augmenting the electric power of the Diesel generators is a set of Exide storage batteries located in the upper engine-room. These have sufficient capacity to supply light and operate the sanitary and other small pumps and auxiliary machinery in the engineroom, should the auxiliary generating sets be shut down.

Interest in the VANDA does not end with the mechanical details of machinery and hull. Accommodations for owner, guests and crew are exceptionally well arranged and every provision is made for comfort in a home-like atmosphere at sea. Interior decorations are in dignified good taste and do not border on the ornate.

Upon boarding her by the owner's gangway on the starboard side, one enters the lobby, panelled in walnut. Immediately forward of this is a combination living and dining room 34 ft. long and 27 ft. wide. Just aft of this is located the owner's suite which includes a sitting-room, dressing-room, wardrobes, bath and large bed room 23 ft. by 15 ft. extending the full width of the deck house. This entire suite is finished in panels and paint work and has large windows with sliding slotted blinds and Pullman shades. Doors from the bed room communicate with a vestible to the after deck, stairway to boat deck, and guests' quarters.

Located at the forward end of the main deck is a smoking room 18 ft. by 23 ft. Further examples of the exceptionally large cabins are guests' rooms, ranging in sizes from 22 ft. by 15 ft. to 16 ft. by 13 ft. each with private bath and wardrobes.

Interior decoration of these rooms is to paneled walls, smooth ceilings and finish in pale shades of ivory, blue and green. Bath room floors are all finished in rubber tile with distinctive base and border. The walls to wainscot height are tiled with non-cracking material of enamel-white.

On top of the pilot house is the searchlight, and standard compass. Abaft the stack there is a steel deck house paneled inside in teak, with large windows. This house has folding doors extending across the entire after end and forming an observation room or deck shelter about 20 ft. by 15 ft.

The windows in all deck-houses are of the sashless type, raised and lowered by turning a handle. Pullman shades and mosquito screens are fitted to all windows.

The launches and lifeboats are placed on the upper or boat deck, and raised by electrically operated winches or hoists. On the starboard side is a 26 ft. owner's launch and a 24 ft. lifeboat, and on the port side a 26 ft. crew's launch, a 24 ft. lifeboat and a dinghy.

Senior and petty officers' quarters are finished throughout in butternut. Ample space is allotted to the crew.

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Reliability, Speed and Comfort Paramount

Diesel Yacht Waledo II Has Most Modern Engine Room Equipment and Beautiful Accommodation

ACHIEVEMENT worthy of attention has been attained in the design and construction of the Diesel yacht WALEDO II. Although only 127 ft. in length, 19 ft. beam and 5 ft. 9 in. draft, she makes a speed of 15 knots while providing a degree of spaciousness and comfort for the owner his guest and crew, not usually found in yachts of this size and speed. She is seaworthy without being cumbersome, sturdy without being heavily constructed and fast without the machinery space greatly encroaching upon the quarters.

Designed by Thomas D. Bowes of Philadelphia, built by The Mathis Yachtbuilding Company, Camden, N. J., and delivered, last June, to her owner, Walter H. Lippincott, she has now been in service long enough to prove her qualities.

To accomplish the light-weight essential to speed, the hull is constructed of wood and steel, cleverly knit together to ensure a maximum of strength and interior space. The keel and center keelson is of wood and double planking is laid on steam-bent frames while the sister keelson, engine keelsons, floor frames fore and aft, and the main watertight bulkheads are all of steel. Clamp-shelves and stringers are a combination of wood and steel and the deck houses and deck are of solid teak.

A survey of her interior arrangement reveals a carefully worked out plan. Complete separation of the crew from the guests is effected and the owner's private quarters are separate from both. The engine room is amidships while the crew's quarters and galley are forward. Between these the owner has a stateroom and bath with an entrance from the deck house above. Aft of the engine room are two double staterooms, three single staterooms, four baths and a store room for the steward's supplies. American walnut is used for the interior finish of the deck house, while the quarters below are finished throughout in Invormica enamel.

Waledo II ready for a cruise

A spacious dining room, with large richly draped square windows on either side and substantial furniture, is made homelike and comfortable by the addition of a rich floor rug in colors to harmonize with the rest of the furnishing. Artificial lighting includes a liberal distribution of artistic wall fixtures and a single ceiling light over the dining table.

Forming a part of the forward deck house, abaft of it and extending over it, is the chart room and pilot house, fitted out with the latest and most approved types of navigating and steer-equipment. Between the after end of the deck house and the forward end of the after deck house is an engine room trunk, supporting the funnel and ventilators, with skylight and hatch over the engine room.

The main salon, a very comfortable and popular lounging room is located in the after deck house with a stairway leading down to the guest's quarters. Awnings extend from this cabin to the forward deck house, covering the engine room trunk and aft over the stern thus making the deck a very comfortable place in hot weather.

Painstaking care has not been devoted to quarters alone; the engine room, upon which depends a high degree of safety at sea, speed, and to a large extent comfort aboard, has also been carefully planned. The two main propelling units are four-cycle, airless-injection, eight-cylinder Bessemer Diesels rated at 300 s.hp. each

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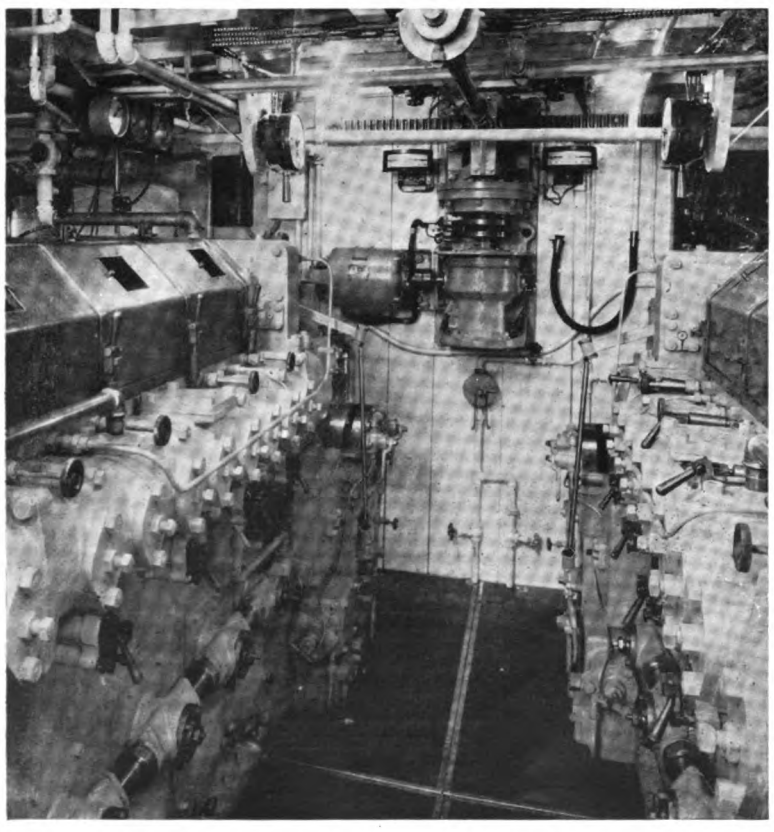

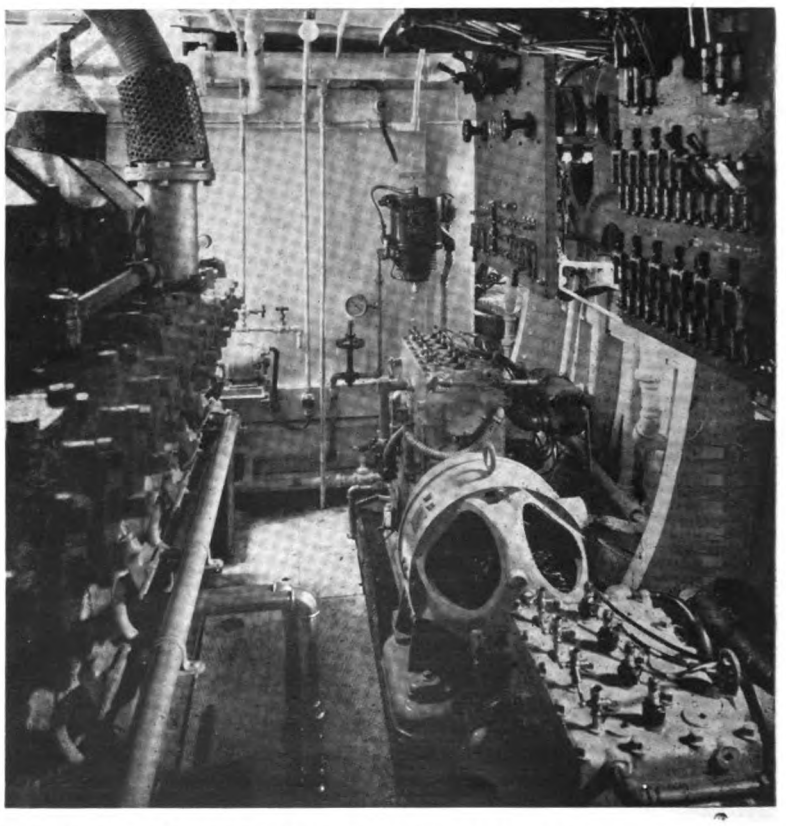

Views of engine room, showing new type Sharpless centrifuge, Sperry steering engine, and Brown pyrometers

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Rejuvenation of An Old Yacht

Pleasure Craft of the Vintage of 1911 Brought to the Class of 1928 by Diesel Power

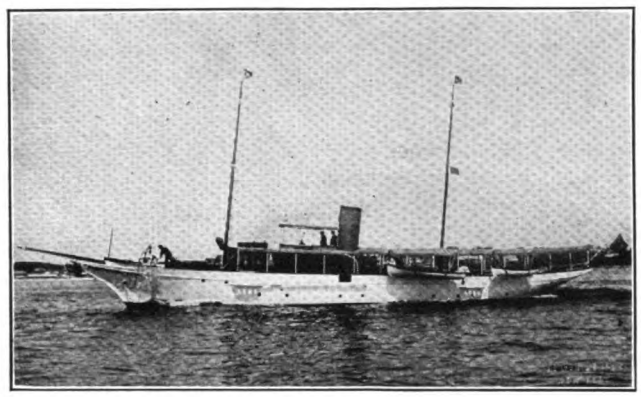
WHAT is the value of an old yacht? In answer to this question we may say that it depends largely on what kind of a yacht she is. If her power plant consists of a steam engine and boiler or a gasoline engine, she is completely out of date as is. That alone may not render her unsuitable for use as a pleasure craft. If her hull has been neglected and her furnishings have become shabby, the owner will no longer look upon her with pride. These are matters of neglect.

The mechanical problem, however, is a different one. The machinery may have received excellent care, but no amount of attention can keep it up to date. It is impossible to alter an existing steam plant or gasoline engine and make of it anything but what it was at the time of installation.

A misapprehension seems to exist in the minds of certain men to the effect that a Diesel engine will cause heavy vibration, and severe stresses not characteristic of other kinds of machinery. As a matter of fact exactly the opposite is true. Records of several yachts that have seen years of service, and later been powered with Diesel engines, prove that the conversion policy is 100 per cent sound, and that vibration is not a deterrent.

Built in 1911, and powered with a gasoline engine the ESOLANIE has recently been converted to Diesel power. She is now staunch and comfortable and her value has increased threefold. Not only did the substitution of the Diesel engine for gasoline power triple her value, but it also multiplied her cruising radius by three. She is now safer, cleaner and free of vibration.

The ESOLANIE is 106 ft. in length, 13 ft. 3 in. beam by 6 ft. 6 in. draft, of the old-fashioned type with clipper bow and long raking stern. She is strongly constructed of wood and comfortably furnished. Just before Sailing W. Baruch sold her she was converted to Standard Diesel power at the plant of Robert Jacob, Incorporated, City Island, New York. The new engine is a 150 b.hp. directly-reversible, six-cylinder, 12 in. by 14 in. four-cycle model. The old propeller was changed for a new one. Although the new power plant is rated at 150 hp. and the old one was rated at 300, the ESOLANIE now makes within half a mile an hour of her former speed.



Since a Diesel was installed, the Esolanie at the age of sixteen performs like a new yacht

The increased cruising radius just mentioned is, of course, the result of retaining the oil-fuel tanks after installing a power plant that requires less fuel per hp. hr. and rated at only half the former power. The tanks of the ESOLANIE now provide 1600 gallons of fuel or 160 hours' supply. With this same weight in gasoline, 2142 gallons were carried, giving sufficient for 58 hours running.

The owner, Mr. Gubelman appears to be almost as much enthused over the elimination of highly volatile and dangerous gasoline aboard his boat as he is over the marked decrease in vibration and quieter operation resulting from the conversion. He realizes that Diesel operation without back fires at a carburetor and possible sparks at the electrical ignition apparatus, along with the absence of gasoline vapors, renders a higher degree of safety to his guests and himself when on ocean cruises, and, of course, reduces insurance cost.

Another point of advantage in the new installation has been demonstrated by the superior maneuvering qualities. On a cruise last summer along the Connecticut River, the powerful backing power of the engine stood in good stead in helping to get off sandbars.

In fitting out for another cruise, it has been found that the Diesel engine will require less attention in the way of overhauling. It is thus apparent that advantages accrued from conversions such as this are not necessarily confined to a saving in cost of fuel alone and an increased radius of operation, but also result in reducing general maintenance.

But the saving in fuel cost on this boat is important.

To fill her tanks with gasoline formerly required the outlay of $385.56 for a period of 58 hours operation; then it was necessary to refill the tanks at similar cost. Now $128.00, with fuel oil at 8 cents a gallon, sufficies to fill the tanks for a run of 160 hours. With this oil at 5 cents a gallon, the bill is only $80.00.

As a yacht is not used constantl,y but for week end trips of perhaps 10 or 12 hours of engine operation plus a two weeks cruise when the engine runs perhaps an average of 5 hours a day, the comparative economy is outstanding.

A survey of the "bone-yard" will reveal many a good yacht lying idle, which might well be placed in service if her power plant were renewed. It is conceivable that to convert yachts such as this would offer inducement to men who do not care to pay the full price of a new one even though the latter is a more desirable craft.

Reliability, Speed and Comfort Paramount

(*Continued from page* 922)

Two Winton gasoline engines are used as auxiliaries, one a six cylinder, 7½ kw. and the other a four-cylinder 5 kw. generating sets. There are two electrically driven air compressors. The largest is a Winton compressor with a capacity of 15 cu. ft. of free air per minute. The stand-by compressor is a Kellog unit of less capacity.

Reminiscent of big ship practice is the piping arrangement by means of which Blackmer rotary pumps, for fire and bilge service, are made to serve both purposes interchangeably through manifolds with separate leads from the engine room to all parts of the vessel. In connection with the main engines lubricating oil systems Sharpless contrifuges are employed to prevent troubles arising through impurities in the oil. In addition to being centrifugally purified the oil is constantly circulated through coolers so a uniform temperature is maintained.

It is almost universally agreed that to keep close tabs on the exhaust-gas temperature is essential to the successful operation of all Diesel engines and this is accomplished on the WALEDO II by means of Brown pyrometers. A separate dial is installed for each engine and separate readings may be made for each cylinder from the central control station. Although the steering gear is not generally considered to be a part of the engine-room equipment; in this instance a Sperry automatic steering engine is located there, convenient to the engineer on watch. The Sperry Master Gyro is also located in the engine room, which, by the way, draws attention to the Edison storage batteries used not only to ensure uninterrupted operation of the Gyro, but for lighting purposes as well. At night, when everyone has retired, and the yacht is in harbor, the operation of engines is not necessary because the batteries supply all of the electric power that is required.

A touch of ultra modernity is revealed in the use of a Frigidaire water-cooled refrigerating unit, and the installation of a Lux fire extinguishing system. Fresh and salt, running cold water, and fresh running hot water is kept on tap by means of Decatur water systems.

Recent reports of the performance of the WALEDO II indicate that she is giving a good account of herself. She is fully as seaworthy as heavier craft of her size and capable of maintaining the speed for which she was designed.

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Small Diesel Cruisers

Fuel Cost Per Mile as Low as That of an Automobile

THE popularity of small pleasure boats has suffered a severe decline during the past decade for two reasons. The automobile being less expensive to operate and more easily taken care of offered opportunities of travel hitherto impossible to the average man of moderate means. At the same time the initial cost of boats has not been reduced and until very recently the cost of operating them has advanced. Now a condition is developing on land which makes the pleasure seeking public continue to use the automobile because they know of no other means of travel superior to it; but it is rumored that road building can not keep pace with the increasing number of cars and an automobile outing in the country amounts to little more than a continuous struggle through one traffic jam after another. There has also been talk of a "saturation point" of automobile ownership, yet it appears to be far distant.

Indications point toward a general search for some new form of recreation involving travel. The airplane? Forget it! The possibility of an aerial-flivver is remote. A few boating enthusiasts have continued to use their motorboats and small cruisers for love of the water and have been willing to bear the cost. They have not been blind, however, to the need of boats that are less expensive to operate. There is little indication that the navy of small pleasure boats will ever assume proportions great enough to seriously affect the automobile industry. On the other hand there a few millions of people living close to rivers, lakes and the sea who would be likely to take to boating if it could be done at a cost comparable to that of maintaining and operating their cars.

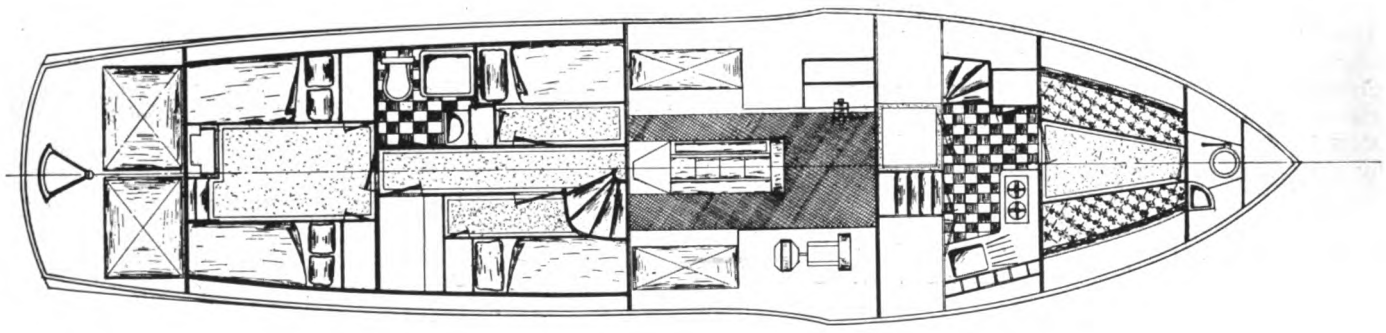
Considering the situation with a view to the possibility of the oil engine relieving the present condition we should take into account the viewpoint of the average small yachtsman. He has long hoped to attain a degree of safety, dependability and economy in the operation of his small boat comparable to that of large Diesel yachts. That this can be done is becoming increasingly evident with the development of light weight high speed Diesels, suitable for such craft. It has even gone further than the development of the engines. Realizing the potential demand for a comparatively inexpensive small cruiser capable of operating at a cost per mile from one-sixth to one-tenth the cost of operating a gasoline boat of similiar size. Frederick P. Humphreys, Inc., naval architects of New York have produced several standardized small Diesel cruisers.

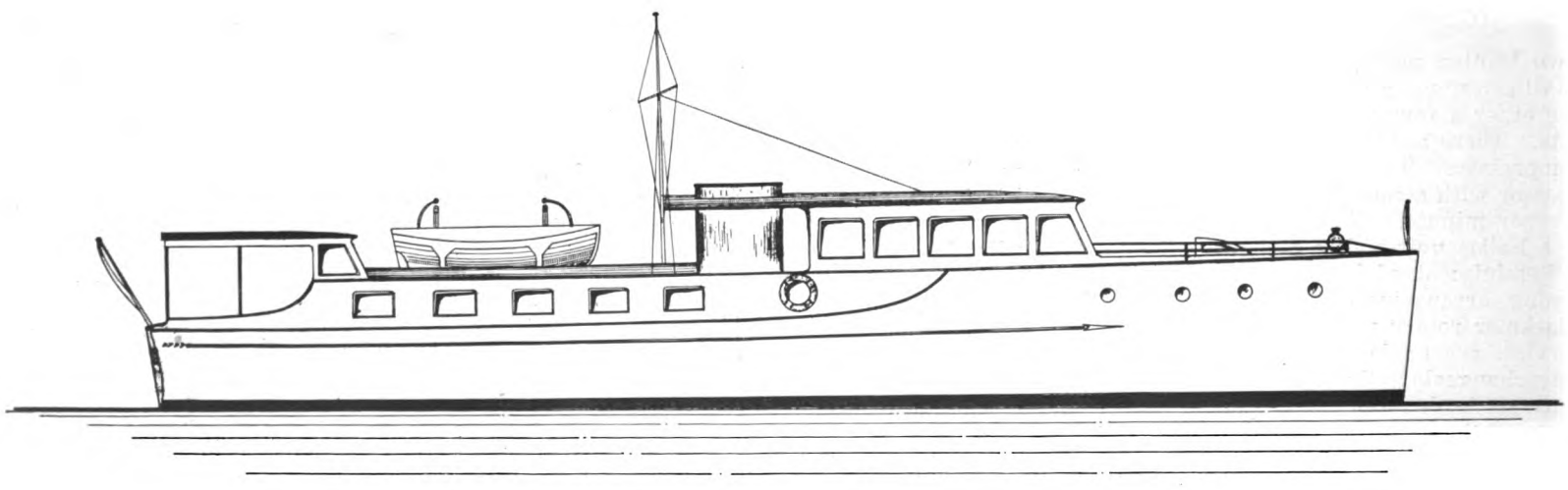
The smallest of these, a 37 footer, is capable of making 10 miles per hour and is said to operate at less than one cent per mile. The average automobile cannot approach this figure. It has a cruising radius of from 500 to 700 miles on one filling of the fuel tank. The engine is a 40 hp. Cummins Diesel. Three larger sizes (42, 54 and 64 feet in length) cruisers are somewhat faster, they have more power and the cruising radius is greater; but, of course, the cost of fuel goes up in proportion to the power used to attain the greater speed.

Accommodation, as compared to an auto, is remarkable, but the engine has little bearing on that. Questions of noise, odor and vibration have been solved about as well as with a high grade gas engine installation. The cost of repairs and depreciation is said to be less with the Diesel which is somewhat simpler to operate and perfectly dependable. But to return to accommodation; even the smallest of these cruisers have two large cabins, with berths for six or eight, two enclosed toilets with lavatories, a galley with sink and ice box, lockers and buffet.

As compared to the gasoline boat there is a factor of safety in the Diesel powered craft that cannot be well overlooked. The dangers attending the presence of gasoline aboard are so universally recognized that a material difference in insurance rates has been made by the different marine underwriters in favor of the Diesel boat. The saving of a few dollars in insurance is not, however, the only attractive feature of the Diesel powered craft. The owner enjoys a feeling of safety, which is even more attractive than the saving in money involved.

The cost of these boats is said to be little if any greater because of the type of machinery used. Such being the case, the field looks promising for small Diesels for gasoline boat owners will surely switch to Diesel power and we may expect quite a number of converts to boating before many seasons have passed. It is merely a matter of educating pleasure seekers.





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Six Diesel Vessels Building At Bath

Two Launchings in October, Two to Follow in November, and Two Keels to Lay

THE BOSTON COLLEGE is the second Diesel powered vessel to be launched at the Bath Iron Works in October; the Diesel yacht VANDA described on another page of this issue being the first. If things go according to schedule two more Diesel trawlers will ship into the Kennebeck river in November; they will be the HOLY CROSS and GEORGETOWN, sister ships to the BOSTON COLLEGE. During the same month the keels of two more Diesel yachts, one a 138 footer and the other a 266 footer will be laid.

William F. Flynn, president of the senior class at Boston College was granted the singular honor of christening the BOSTON COLLEGE. King Albert of Belgium christened the freighter CHATEAU THIERRY launched shortly after the war at Hog Island. So far as we know he and Mr. Flynn are the only men who have christened ships built in America.

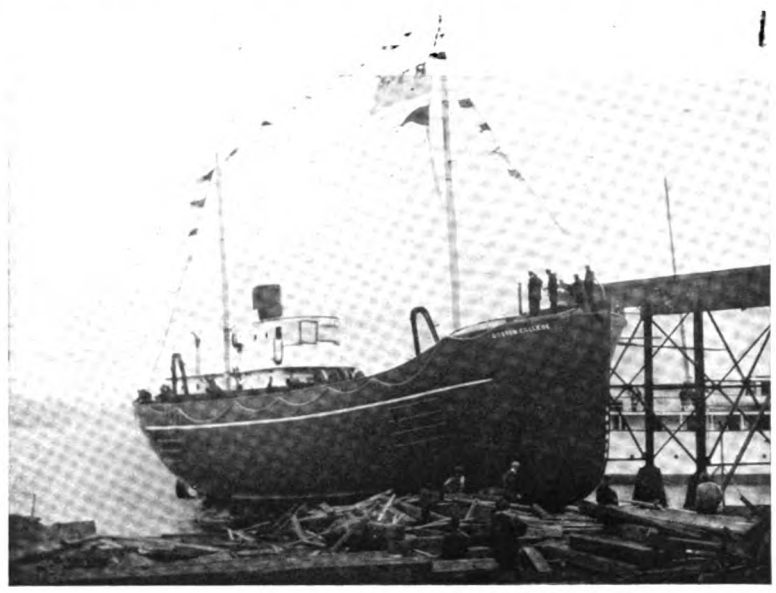
The novelty of seeing a husky college boy with a huge bouquet of flowers on one arm and a bottle of ginger ale in the other hand about to pelt the pugnacious nose of a sturdy little fishing vessel was not all that drew crowds to the street above and the bridge beyond the shipyard. Residents of Bath are ship-minded. Many of them know that the small fleet of American trawlers is principally steam powered and of the vintage of 1906. They can visualize this modern and far more efficient Diesel powered type of vessel coming into the scene, to the exclusion of all steam craft of her kind. They can hope, with the one remaining shipyard in Bath having the benefit of early experience in their construction, that more work of this kind will come to them.

The BOSTON COLLEGE is a sturdy vessel built of steel throughout to meet the requirements of heavy North Atlantic service. Her principal dimensions are:

Length o.a.	124 ft.
Length o.w.l.	116 ft.
Beam	23 ft.
Depth	13 ft.
Depth load draft	10 ft. 9 in.
Power	360 b.hp.
Sea speed (estimated)	9½ knots

Calculated to give exceptionally stiff hull construction the frames are closely spaced and the decks are plated with steel, covered by three inch wood decking. The hull is divided into six main compartments by five watertight transverse bulkheads and subdivided into eleven watertight compartments including built-in water and fuel storage tanks. Storage is provided in these for 18,000 gallons of fuel, 1700 gallons of fresh water and in the cork insulated fish hold for 7000 cu.ft.—about 140 tons—of fish and ice. Large fish capacity such as this is unusual in trawlers of this size, and is due principally to the use of Diesel power and its elimination of a boiler-room, larger fuel and fresh water space and, in the case of coal burners, enormous coal bunkers essential to a reasonable cruising radius with steam power.

The main propelling unit of the BOSTON COLLEGE is a Fairbanks-Morse 400 b.hp. Diesel with attached maneuvering air compressor, circulating water and lubricating oil pumps. A 100 b.hp. auxiliary Diesel of the same make is direct connected to an 80 Kw. 125 volt d.c. generator and supplies power for the operation of engineroom auxiliaries and the deck machinery including a trawl winch with a 75 hp. motor.



Launching the Boston College, first of three Diesel trawlers building at Bath

FOR a number of years American fishing companies have been experimenting with beam trawlers. They have been uncertain of their methods and so the majority of American trawlers are old steam powered vessels salvaged from other service; the number of which has grown to fifty odd. Meanwhile operators of other types of fishing vessels have unanimously adapted Diesel power which has already proven its superiority. Prominent fishing companies now have placed contracts for a number of all-steel Diesel trawlers to be placed in service shortly. It is apparent that these new vessels are the forerunners of a large fleet of similar Diesel-powered craft.

A smaller engine-room auxiliary set consists of a 2-cylinder Colo Diesel of 16 b.hp. direct connected to a 10 Kw. 32-45 volt Diehl d.c. generator. Mounted on the same sub-base is a small Gould centrifugal general service pump and Curtiss emergency compressor both connected to the engine by means of Cutler Hammer magnetic clutches and driven by Link-Belt silent chains. The assembly of these into one unit is made especially for fishing vessel service by Blomfield, and mounted on a base made by them.

Further provision for emergency power is made with the installation of a small gasoline engine generating set, which, by the way, adds materially to the insurance rate. Side by side with this somewhat illogical use of a gasoline engine is an excellent storage battery installation, consisting of 24 Edison cells used for lighting purposes when no engines are running.

Steam to heat the quarters, operate a cod liver oil cooker, and for thawing out is supplied by a small vertical oil fired boiler. Hand pumps are provided for oil transfer and bilge pumping. The regular sanitary, fire and bilge pumps are power driven.

Standard beam trawler deck equipment embraces gallows, fairlead bollards and sheaves, buffer stanchions, etc. The decks are divided into ponds and the hold into small compartments for the respective sorting and stowage in ice, of fish. Handling and mooring gear is of the best while the steering and navigating equipment conforms to standard North Sea trawler practice. Two sturdy masts carry lights, wireless antenna and are rigged with booms for handling fish, nets and boats.

The upper forecastle deck carries anchor davit, mooring chalk, bitts, breakwater and hand capstan. Convenient stowage of nets and gear is provided in the upper forecastle and the lower forecastle provides the crew with comfortable quarters.

The captain has a private cabin abaft the pilot-house, while the engineers, wireless operator and petty officers are housed between decks in the stern. In the after end of the deck-house is a galley and messroom, ice-box, store-room and toilet. In the forward end is a deck hoist motor room open to the upper engine room. An engine-room trunk joins both ends of the deck-house and carries an engine-room skylight and stack.

The BOSTON COLLEGE and her two sister ships were designed by the Bath Iron Works to meet the requirements and approval of their owners the Atlantic & Pacific Fish Co.

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Interesting News and Notes From Everywhere

THE Elder Dempster Line has ordered four more 4000 tons motorships from Clyde shipyards.

The Nakskov Skibsvaerft, of Nakskov, Denmark, have completed the twin-screw motor-tanker HILDA KNUDSEN, for Messrs, Knut Knutsen, O.A.S., Haugesund.

The seventeenth annual convention of the American Association of Port Authorities is being held at Houston, Texas, on November 12, 13 and 14 next, and at Galveston on November 15.

Orders for a light-draft twin-screw motorship of the shade deck type for passenger, cargo and cattle carrying services on a South American river, have been placed with Henry Robb, Ltd., Leith.

Nearing completion in Holland is the 7200 tons displacement passenger motorliner OPHIR, building to the order of the Royal Packet Navigation Co. Two 2300 s.hp. Werkspoor Diesel engines are installed. A speed if 15¼ knots is expected.

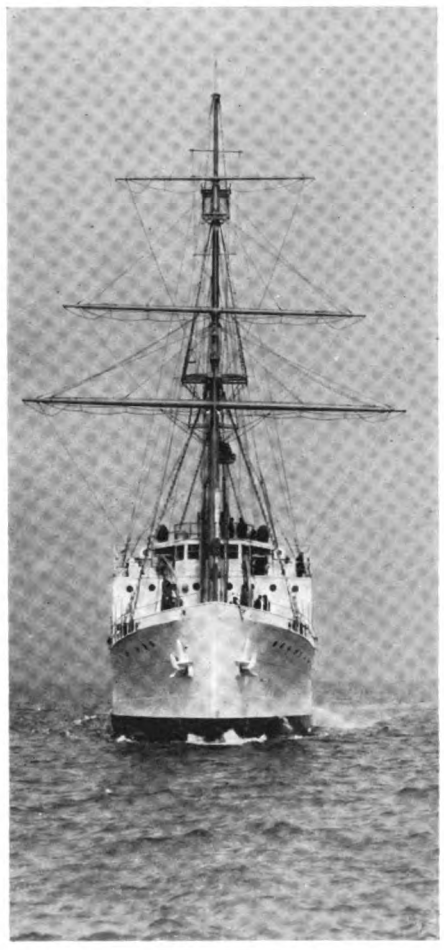
Wilhelmsen's new motorship TALLEYRAND was able to make 15 knots in fully loaded condition on a recent round voyage from Norwegian ports to the Far East. From Freemantle to Dunkirk she beat the North German Lloyd's steamer ALLER'S record run by 18 hours.

FINNANGER, a 13,600 tons Diesel tanker built at the Netherlands shipyard, Amsterdam, has run trials. Her loaded displacement is 19,250 tons on 27 ft. 5¾ in. draft, and she has a total cubic capacity of 677,000 ft. in 28 main and summer tanks. She is propelled by Workspoor Diesels of 4540 i.hp., giving her a service speed of 11 knots.

A passenger motorliner, bigger than the AORANGI, is about to be ordered by the Union Steamship Co. of New Zealand. Bids are called on Sulzer, Doxford or Burmeister & Wain Diesels with geared turbines as an alternative. She will have a displacement of 29,000 tons, or 7000 tons larger than the AORANGI. Length 655 ft. oa., 630 ft. bp.; breadth, 83 ft. 9 in.

The Falk Corporation announces the appointment of B. W. Rogers, to be located in offces at Akron, Ohio, as their representative for Akron and environs. Mr. Rogers had previously been connected with the B. F. Goodrich Company in that city and before that had been with the Allis-Chalmers Manufacturing Company for some years. He will handle Falk herringbone gears, speed reducers and flexible couplings.

Satisfactory trials were recently completed with the motor-tanker BERG. She is a single-screw vessel of 8260 ton dw.c., built by the Odense Staal Skibsvaerft to the account of the A. S. Atlantica, Oslo. She is 411 ft. in length, 55 ft. in breadth and 30 ft. 8 in. in depth. The propelling machinery consists of a set of single-acting four-cycle B. & W. type Diesels with a total power of 3070 i.hp. at 107 r.p.m. which gives her a service speed of 12 knots.



The Coast Guard cutter Northland returns from a successful Arctic cruise

The Antwerp municipality called for tenders to be presented in Antwerp October 15 for the construction of one steel Diesel saloon boat capable of carrying forty passengers. Another contract has been placed with the Schelde Company for the building of 15 knot motor-cargo liners, to be placed on the fast cargo service from Hamburg to Rotterdam according to a recent report of the Rotterdam Lloyd. Machinery to be installed will include an eight-cylinder 5500 b.hp. Sulzer main propelling unit.

WINCHESTER CASTLE and WARWICK CASTLE are the names of two 20,000 ton motor liners building at the Harland & Wolff plant, Belfast, for the Union Castle Mail Company. The first vessel of the two intermediate motor liners under construction in the firm's Govan yard is to be called LLANGIBLY CASTLE.

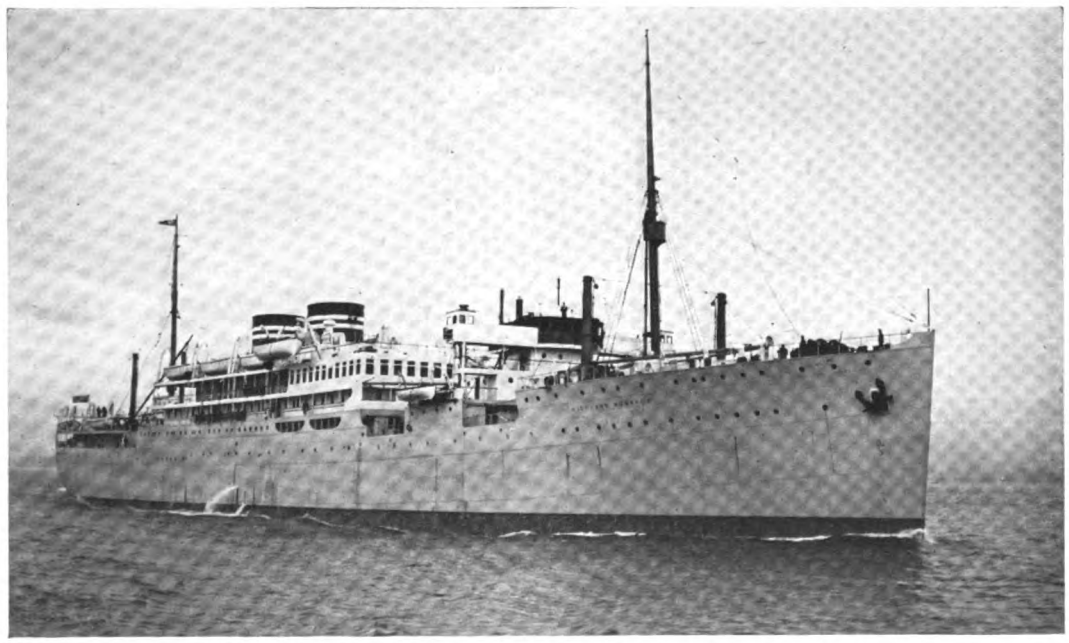
For the French Navy 19 submarine of 1,560 tons each are to be completed shortly. Each submarine is to have two 3,000 s.hp. Diesel engines. The submerged displacement of the submarines is 2,080 tons. Surface speed 18.25 knots.

Two Sulzer 1,500 s.hp. Diesel engines are to be installed in each of two despatch boats of 2,000 tons displacement for the French Navy Colonial Service.

The Italian Government has started a modern Diesel ferry-boat service between Civitavecchia (38 miles north of Rome), and the port of Terranova, in the island of Sardinia. Hitherto ordinary steamships were used for the transshipment of cars and trucks and much delay and expense are said to have resulted from the lack of modern conveyances. Details of the first ferry-boat used on this new service follow: Length, 308 ft.; breadth, 50.5 ft.; draft, 10.7 ft.; engines, two Diesels of 800 b.hp. each; propellers, twin screws; type of deck tracks for cars, three tracks installed on deck, with switch; total crew, 40; tonnage, 2208 tons. The ferryboat is named the MESSINA, and is owned by the Italian State Railways.

Marking the end of her first cruise into the far northern waters, the new Coast Guard cutter NORTHLAND returned to her base at Oakland, California. When her builders delivered the NORTHLAND to the government in the summer of 1927 it was too late for her to work further north than the Bering Sea waters. This year she got away early in May and went the full length of her beat; to the very end, in fact, and touched at every United States settlement on the "roof of the world."

The NORTHLAND is a Diesel electric vessel, and was fully described in the June, 1927, issue of MOTORSHIP. The two main Diesel generating sets are of McIntosh & Seymour and General Electric manufacture. With two engines of 600 b.h.p. each power



Highland Monarch, a new 15-knot Diesel ship built by Harland and Wolff for passenger freight and refrigerated cargo service between England and South America (*See page* 935)

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is supplied to one main propulsion motor of 1,000 s.hp. and for auxiliary purposes. The sea speed is 11½ knots.

The excellent performance of this vessel has amply justified the government's decision to gradually replace its old Coast Guard units with Diesel propelled craft. Vessels so powered are particularly well suited for work along remote shores where fueling stations are far apart.

The motor-liner, CREOLE JEFE, building together with two sister ships for American owners, namely, the Gulf Refining Company and an unnamed client of Sir Joseph Isherwood, was launched at Palmers Shipbuilding & Iron Company, Ltd., on September 12. Up to the present time this shipyard has built fifteen vessels for American owners.

CALIFORNIA STANDARD, a 15,600 dw. ton motortanker, building for the Standard Oil Company of California at Germania Werft, Kiel, and to be powered with twin two-cycle four-cylinder 3600 hp. Krupp Diesels, giving a sea speed of 11½ knots, was launched recently. Principal dimensions are: length, 405 ft.; beam, 54 ft., and depth, 30 ft. 3 in.

There was recently launched in England a large freight car carrying ship for service between New Orleans and Havana. The SEATRAIN, as she is named, is building for the Overseas Railways, Inc., of New York, Graham M. Brush, vice-president and treasurer, by Swan, Hunter & Wigham-Richardson, Ltd., Wallsend-on-Tyne, England. She is of 7000 tons dw. and will carry 92 freight cars.

Orders received by the General Electric Company for the three months ended September 30 amounted to $90,328,666, compared with $77,420,263, for the corresponding quarter of 1927, an increase of 17 per cent, President Gerard Swope has announced. For the nine months ended September 30 orders received amounted to $260,686,463, compared with $233,076,091, for the first nine months of last year, an increase of 12 per cent.

The Netherland Shipbuilding Company recently delivered a tanker of 19,250 tons displacement and 11-knot speed to Westphal-Larsen of Bergen. She has a capacity of 562,000 cu. ft. with an additional capacity of 115,000 cu. ft. in inner tanks. The loading capacity is 13,600 tons at 27 ft. 5¾ in. draft. The fuel capacity is 1048 tons. She is propelled by two Werkspoor six-cylinder Diesels, 26⅜ in. dia. by 47¼ in. stroke, developing 4540 s.hp. in aggregate.

No bids were made for Diesel installation in the MOUNT VERNON and MONTICELLO. The bids for reconditioning in accordance with the several plans under consideration were higher than the $12,000,000 appropriated by Congress. Future attitude and action has not yet been announced by the Board.

Fairfield-Sulzer Diesels of about 8000 s.hp. are to be installed in the Bibby Line's motorliner STAFFORDSHIRE.

The 7200 ton motor liner OPHIR, building to the account of Koninklijke Paketvaart Maatschappij at the Netherland Shipbuilding Company, Amsterdam, was launched recently. The propelling machinery is twin 8-cylinder single-acting 4-cycle Diesels supplied by the Werkspoor Company, developing 2300 b.hp.

Fifteenth Motorship of the Johnson Line

MARGARET JOHNSON, the sixth large motorship built at Götaverken for the Johnson Line, Stockholm, ran successful trials and was turned over to her owners in September. First Swedish shipping company to replace their steam tonnage with modern motorships, the Johnson Line now owns fifteen splendid cargo and passenger motorships. The MARGARET JOHNSON is somewhat longer and faster then the motorships AXEL JOHNSON and ANNIE JOHNSON built at Götaverken in 1923 for the same owners. Other than the difference mentioned she conforms to the plans of the earlier ships, all of which reflect a great deal of credit on the owners and builders, and especially on the technical director of the company, A. Krommow.

Principal Dimensions of Ms. Margaret Johnson

Length over all	420 ft.
Length b.p.	405 ft.
Breadth moulded	54 ft.
Depth to shelter deck	37 ft.
Deadweight capacity (at 24 ft. 9 in. draft)	7250 tons.
Trial trip speed (at 5100 i.hp.)	14.84 knots.

The two main engines are six-cylinder Götaverken B & W Diesels designed to develop 2300 i.hp. each at 125 r.p.m. They are of crosshead type with a cylinder bore of 24.8 in. and a stroke of 51.18 in. Three Diesel generating sets of 100 kw each operate at 400 r.p.m.

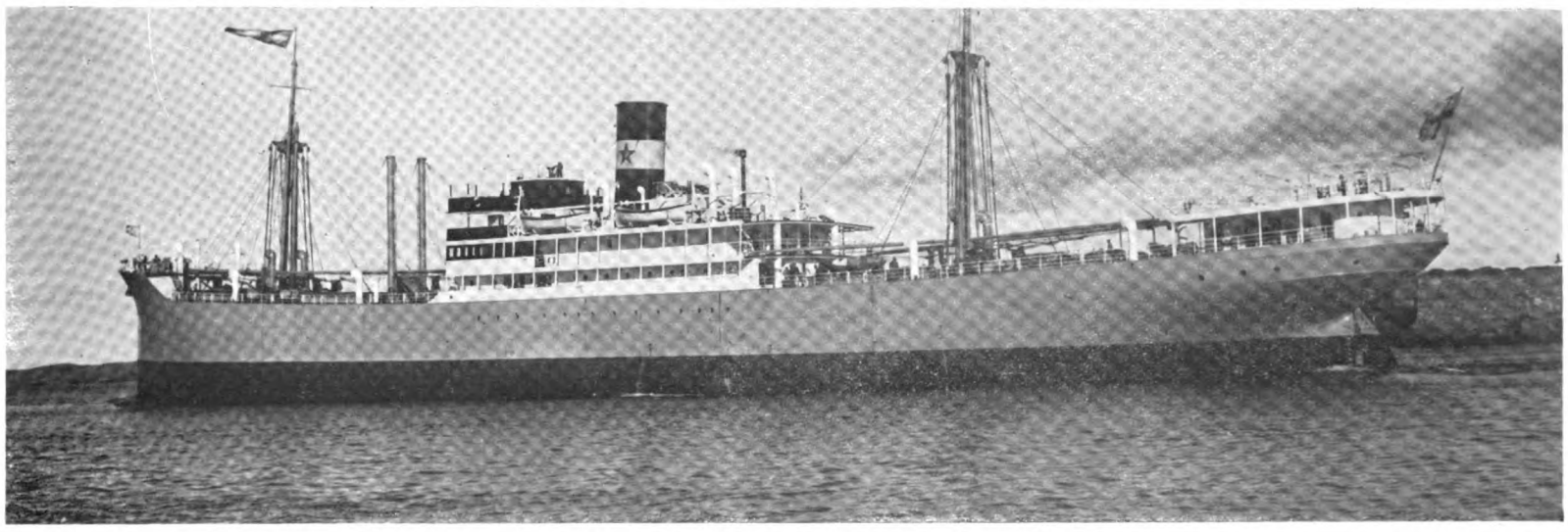
The New York Shipbuilding Co. has been reorganized and is now a subsidiary of the American Brown Boveri Electric corporation. All real estate and plant embracing the shipbuilding activities at Camden, N. J., are under lease to the new company taking over for competition all existing contracts of the parent company.

It is appropriate that this reorganization bring into existence again the name "New York Ship" known throughout the world for the excellent character of its work extending over many years of successful ship construction.

A noteworthy Diesel motorships development is to be found in the 16,000 gross tons passenger motorliner just ordered by the Pacific Steam Navigation Co. from Harland & Wolff. The power installation is to consist of four Harland-B. & W. twelve-cylinder, trunk-piston, airless-injection Diesel engines. If American coastwise passenger-ship owners adopted this form of power, instead of figuring on slow-speed, heavy, crosshead engines, they would find that the first cost would be lower, and that there would be considerable space and weight gains on short voyages.

The Argentine Navigation Company (Nicolas Mahanovich), London and Buenos Aires, have placed, with A. & J. Inglis, Pointhouse Shipyard, orders for two triple-screw motor passenger vessels, specially designed for the firm's service between Buenos Aires and Asuncion. Each vessel will be 305 ft. in length, 58 ft. 6 in. in breadth and 11 ft. 6 in. in depth. The propelling machinery will be three Harland-B. & W. four-cycle Diesel engines, developing a total of 2600 b.hp., and giving a speed of 14½ knots. The Argentine Navigation Company recently placed with Inglis & Company, an order for two twin-screw motorships, each of about 1400 tons.

Two of the six cargo vessels ordered by the Bank Line, Workman, Clark, Ltd., Belfast, are to be Diesel powered. The Diesels will be constructed by Workman, Clark at their works in Belfast, who have already successfully installed similar engines in the Anglo-American Oil Company's tanker CHESAPEAKE. This is the first order given by the Bank Line for Sulzer engines. They already have a large fleet of cargo ships with Harland-B. & W. Diesels which have given very satisfactory results. The new vessels, six in number, are intended for the owners' trade between Nairu and Australia carrying phosphate, some 5,000,000 tons of which it is said will be transported to Australia. Delivery of the new ships will be completed in two years. They are to be over 9000 tons deadweight each, and will be built to a high-class specification.



Built as the result of the excellent performance of fourteen earlier motorships of the same fleet, the Margaret Johnson reflects great credit on her builders

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Progress in the Art of Stabilization

An Explanation Invaluable to the Technician, Understandable to the Layman

IN THREE PARTS—PART III

(Continued from September Issue)

By R. W. Crowly

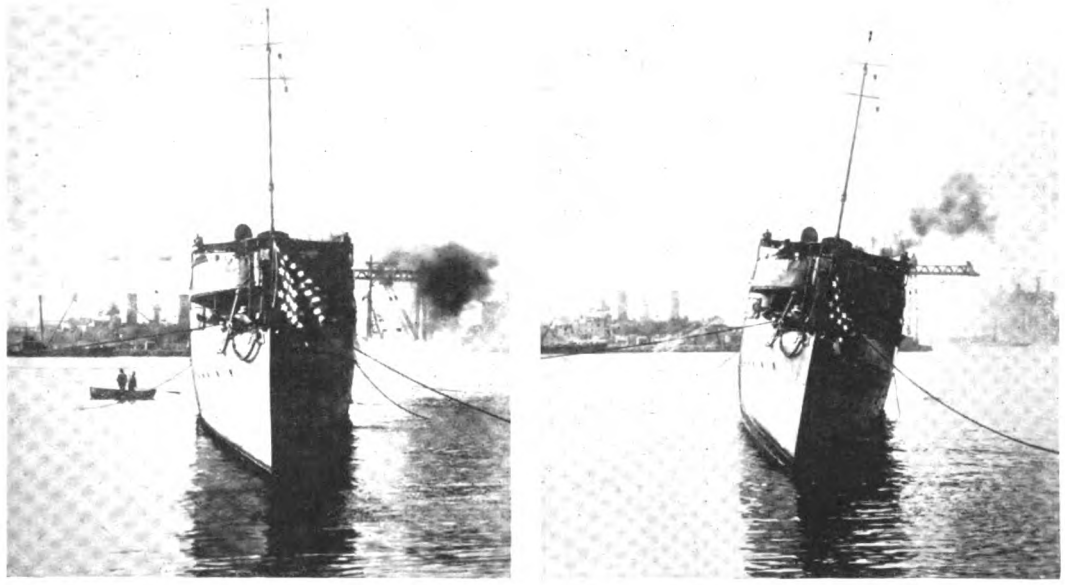
A GREAT difficulty that confronts some people in contemplating the subject of stabilization is an erroneous impression that big forces must be brought into play to suppress rolling. That same impression has probably been held at one time by everybody who today understands that only small forces are brought into action in stabilizing a vessel.

Mr. Scheel, the owner of the TENINO, wrote: ". . . It was my impression prior to my experience with the stabilizer that to keep a ship from rolling would cause terrific local stresses upon the hull structure; this opinion I have found is almost universal among seagoing men who have not been shipmates with a stabilized vessel. After the TENINO had her trials at sea I was soon convinced that there were practically no undue local stresses in evidence due to keeping the vessel from rolling. I have made all kinds of investigations to ascertain whether any violent shock or steady stresses were acting upon the structure while the vessel was being stabilized; also I have challenged a number of experienced engineers who were ready to tell me just what would take place, to find the slightest evidence of damaging forces; in all cases they have failed. Now, of course, it is very simple for me to understand the absence of the supposed damaging stresses when it is remembered that less than ten horsepower is required to keep the vessel steady in the worst of sea conditions. . . ." This point about the absence of heavy stresses is further driven home by the explanation previously given that the TENINO'S stabilizer is held down by lag screws to the wood frames. Would those fastenings not be torn loose if there were any heavy stresses transmitted through them?

Let us try to discover the solution to this puzzle that there are no heavy stresses when almost everybody thinks there must be terrific straining, and let us not use any higher mathematics in the attempt. If you have ever gone aground in a small boat on soft bottom you have surely participated in the strenuous process of working her free by rolling. The first time the weight of all aboard is transferred to one side the boat will heel through a very small angle, the next time the angle will be greater, and after a little practice, when every one has learned the tempo, the rolling can be increased to a wide arc. Through all this, that is to say for the first small roll as well as for the last long roll, you have only the same force to work with, namely the force due to the weight of those aboard.

Evidently, therefore, the rolling of a boat does not depend upon the force alone, and there must be some other element involved. The pure mathematician will object to this example because the boat is not entirely free to roll when the keel is aground, and the objection is valid from a mathematical standpoint, but so long as the example helps us to understand we need not quibble over the objection. When the boat floats freely the same building-up process can be employed to make her roll, but the maximum will be reached more quickly and with far less effort.

If we try now to get a measure of the differences between the force that will heel a vessel through a certain angle and hold her there and the minimum force that can be used to build up a roll that will put the vessel over to the same angle we shall be able to appreciate how different the conditions can be. Hereunder are two illustrations of the U. S. S. WORDEN showing her respectively on an even keel and listed to an angle of 6 degrees in still water. A weight of 5 tons on deck 10 ft. off the longitudinal center line is required to heel her to this angle, but if we were to employ means for the transfer of a weight to and fro, from 10 ft. off the center line on one side to 10 ft. off the center line on the other side at a rate we are free to select for the purpose we shall be able to build up a roll that will carry her over to the angle of 6 degrees with the aid of less than 1 ton.



By experiment the U. S. Worden was listed six degrees with under five tons placed ten feet off longitudinal center

Clearly therefore a big difference exists between a plain list to a certain angle and a built-up roll to the same angle. It is indeed surprising what a relatively small force can be used to build up a big roll, and possibly the lack of distinction generally made between the two sets of conditions is basically responsible for the widespread misconceptions about the forces involved in the rolling of vessels.

In the inclining tests of vessels—as required, for instance, by the U. S. Steamboat Inspection Service for all passenger boats exceeding 500 tons gross—weights are moved across the deck with the aid of blocks and tackle in order to permit certain measurements to be made which afford a check on the naval architect's calculations. Because the test involves really nothing more than the listing of the vessel the weights employed seem very big in comparison with the angle of heel that is measured. Actually, if those same weights could be moved to and fro athwartships at a certain calculated rate the vessel could be made to roll to an angle many times greater.

If we turn now to the consideration of the opposite problem we shall be dealing with the means for suppressing a roll due to wave motion instead of discussing how to build up the rolling of a vessel in still water. We are prepared to note when we look at the graphic record of the rolling of the British destroyer VIVIEN that she builds up her rolling to a maximum about every 2 minutes when she is not controlled by the stabilizer. The rolling creeps up from a minimum of, say, 10 degrees, adding a few degrees on each side at each successive roll until after attaining an arc of 35, 37, 38, 41 and finally a maximum of 44 degrees the rhythm with the waves is lost and the rolling quenches itself, only to pick up again as the vessel gets into tune again with the wave motion. Obviously no greater force is at work on the big, wide, sweeping rolls than on the small ones. If we can quench or damp the small roll we do not have to worry about the big roll, because that will not have an opportunity of building itself up. This indeed is the action of the Sperry stabilizer.

It is electrically controlled and automatic. As soon as the vessel leaves the vertical by so little as one-quarter degree it begins to apply a quenching force, and by getting into action so quickly it prevents the roll exceeding two, three or four degrees, with an occasional maximum of five degrees. Therefore it does not even have to apply a force big enough to suppress a roll of 10 degrees. Is that clear?

Still looking at the graphic record of the British destroyer's test, you may query whether when the stabilizer was cut into action after the roll of 35 degrees had built itself up there was not an abrupt shock to the

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boat in having the rolling so quickly checked. It is a good question because it strikes at the heart of a common misunderstanding. The answer is, there is no such shock, and you can probably explain this to yourself if you in turn are asked whether you think there is a shock to the vessel when the stabilizer is cut out and the boat permitted again to roll. Just as no shock occurs under the latter circumstances, because the roll is not produced instantaneously, but only in accord with her natural aptitude for rolling (the natural period of rolling, as the technicians call it), so also is there no shock when the stabilizer is cut in, because the rolling is not instantaneously suppressed, but is only checked on each natural roll without altering the period or duration of the roll at all.

If you count the rolls on the graph presented in a previous chapter, you will see that whether the destroyer was rolling 10 degrees or whether she was rolling 44 degrees she made practically the same number of rolls per minute. When the stabilizer was brought into action and the rolling was damped to a few degrees she still made the same number of rolls per minute, but they were so small as to be scarcely noticeable.

A vessel rolls just about as regularly as a pendulum swings. Some roll fast, others roll slowly, just as a short pendulum will swing fast and a long pendulum will swing slowly. Long or short, each pendulum will swing a certain number of times a minute whether the swings be wide or narrow. If you have ever stopped the long pendulum of a grandfather clock you know that a slight resistance properly applied to it on both sides of its swing will, in a couple of periods, bring it to as near a stop as one can ever expect of such a long, dangling weight. You do not strain the pendulum in doing that. Similarly you do not strain a vessel when you check its rolling in unison with its natural rolling period.

If you inquire how a Sperry stabilizer produces the quenching force you will not find the answer here, because that would lead into the realm of mathematics. We will instead attempt to go around the subject. The Sperry stabilizer consists essentially of a gyroscope.

A gyroscope has traits which we, who do not understand them well, consider somewhat mystifying. It can be moved in one direction quite tractably—the direction in which the ship is going, for instance—but if you bear down on it in another direction it acts in just the same way as a human being does when unexpectedly given a gentle urge in the back, namely the movement is made at a right angle to the direction you expect. So when the gyroscope is tipped ahead or astern it responds with a downward effort on the port side or starboard side, as the case may be.

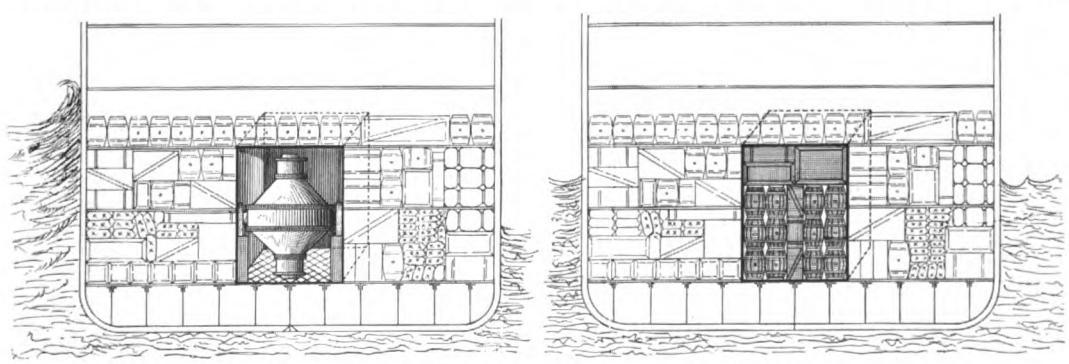
The force thus produced is relatively small, but if applied at the right moment is very effective. You know it is relatively small when you learn how little power is used to tip the gyroscope. In the FAN KWAI a one-third hp. electric motor is used for this purpose; in the ARAMIS a two and one-half hp. motor did the trick, in the big Navy transport HENDENSON a motor of no more than 75 hp. performs the service, but the average duty required from these motors is about one-third of the maximum. And if you are interested in learning the maximum power needed to keep the gyroscope rotor turning at the rated speed it is four hp, in the FAN KWAI, was eight hp. in the ARAMIS and is only 120 hp. in the 10,000 ton HENDERSON. These powers are utilized only for the worst sea conditions, and in a moderate sea might be cut perhaps one-half. With those powers it is obvious the stabilizer action is dependent largely on something more than power—and that "something" is of course the timeliness of its application.

There remains only to explain now how the Sperry stabilizer is enabled to work automatically. For this purpose a miniature gyroscope, known as the control gyro is employed. It works exactly the opposite to the stabilizer, because it is left free to act with the ship, and therefore when the vessel rolls to one side and you might think the control gyro would follow to the same side, she does not do that, but in her funny little way tips forward. Conversely when the vessel rolls to the other side the control gyro tips back.

This seemingly contrary, but perfectly natural, behavior just suits the purpose. When the vessel starts to roll, the control gyro, in beginning to tip forward, closes a contact in the circuit of the electric motor used for tipping the stabilizer gyro, which then immediately begins to stabilize the vessel, because, as you remember, when the stabilizer gyro is tipped ahead it responds with a downward force on one side and when tipped astern sets up a downward force on the other side, and the control gyro has a contact on each side. This downward force acts on the stabilizer foundation and through that in turn acts on the floors of the ship, thus applying the righting effort that overcomes the heeling effort and so prevents the rolling.

This explains why the TENINO'S stabilizer can act so well, even though held down to the wooden deck only by lag screws. The stabilizer force acts as a couple pressing down on one bearing and up on the other. The actual load on the frame when the downward force is applied is the sum of one-half the weight plus the gyroscopic moment, whereas on the other side, the actual force, acting upon the frame, is reduced by one-half the weight of the stabilizer. It can be seen, therefore, that the downward forces are always considerably greater than the upward forces and these are, of course, easier to take care of. The load which this stabilizing force imposes on the floors and keel is small. In a freighter it would be less than the load permitted for cargo.

To show what this means let us look at the sketch of a section through a cargo hold loaded to the limit permitted by the classification societies. The cargo exerts a downward force which is transmitted by the decks to the frames and pillars and so to the floors and keel. If we carve out of the holds a compartment for a stabilizer, a compartment only just big enough for the apparatus—as shown in the right hand sketch—then the maximum downward force the stabilizer can ever exert will not produce as heavy a load on the frames and keel as was imposed by the cargo it has displaced. And that downward force is the only action of the stabilizer. It is easy enough to check this statement; ask the American Bureau of Shipping or any of the other classification societies.



The maximum downward force of the stabilizer is less than cargo occupying an equal amount of space

In this article the attempt has been made to present in simple language the use of stabilizers, their action and their possibilities. If it succeeds in explaining the subject to even a few only of those who should be contemplating the services that non-rolling ships will be found capable of rendering and if it assists to dispel some of the baseless prejudice which so unfortunately exists against stabilization it will have served a very useful purpose. There is no doubt that the suppression of rolling is going to be one of the biggest improvements ever given to marine transportation, even though its recognition may come but slowly.

Effecting Economies in Ship Operation

It is well known that a number of American shipowners build and operate their ships under the British flag in order to reduce overhead and operating costs. Consequently it almost draws a smile when *Syren and Shipping*, of London, in a recent issue states that—"it is clear that something is seriously amiss either with himself or with the country to which he owes allegiance when a presumably good citizen declares that the time has come to throw patriotism to the winds." But, *Syren and Shipping* does not refer to American shipowners operating ships under the American flag, but to a statement by T. A. Seed of the Seed Shipping Company of Newcastle, England, who has obtained the shareholders' sanction to transferring four of the company's ships to the Latvian registry *in order to save* $7,500 *per year per vessel.*

Syren and Shipping indicates how wretched is the plight of the British shipping industry.—"High wages, onerous Government regulations, and various other disabilities hit the British shipowner very hard, and render it in fact almost impossible for him to make ends meet."

It would seem that American shipowners make the mistake of building to British registry when they should construct under the Latvian flag and make greater saving. Our own confidential opinion is that American owned ships can be operated more economically under the American flag when all-round reasons are properly considered, regardless of the La Follette law. If there is any shipowner who cannot agree, wants to know how, and is not afraid of the truth, we will print the cold facts. From our own observation there are innumerable ways of effecting economies in operation not yet touched upon.

One sort of black bottom is found on engineers who have too much lead in the seat of their overalls. A rough chief would change it to black and blue with his boot—but times have changed.

An unbelievably large number of engineers learned the game by serving their time on the Clyde; if you don't believe it just sit in the port-engineer's office and count the applicants who use that as prima-facie evidence of their extraordinary capability.

A sure way to keep from getting a good berth is to keep moving from ship to ship.

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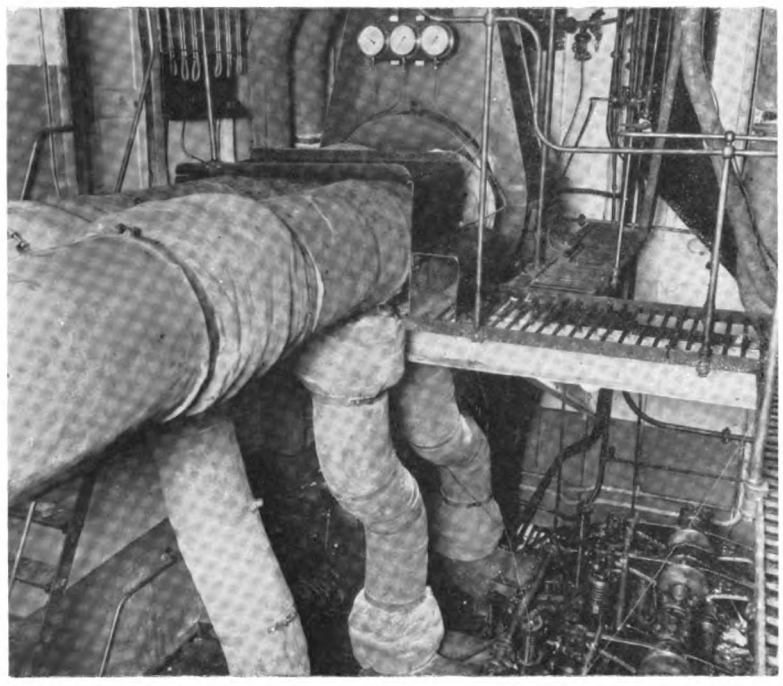
Exhaust-Turbo Charging Increases Speed By 1.43 Knots

Werkspoor Engines of M. S. Raby Castle Converted to Buchi System Now Have 30 Percent More Power

CONVERSION to the Buchi system of exhaust turbo charging was recently completed on the British motorship RABY CASTLE at the North Eastern Marine Engineering works, Wallsend-on-Tyne. The purpose of this conversion was to increase the ship's speed approximately one knot without increasing the main engines, cylinder bore, stroke or r.p.m. Results attained on official trial following conversion indicate an increase in the ship's speed of 1.43 knots. Contrary to results obtained by ordinary methods of supercharging there appears to be no decrease in engine efficiency and the rate of fuel consumption per i.hp. hr. has decreased slightly.

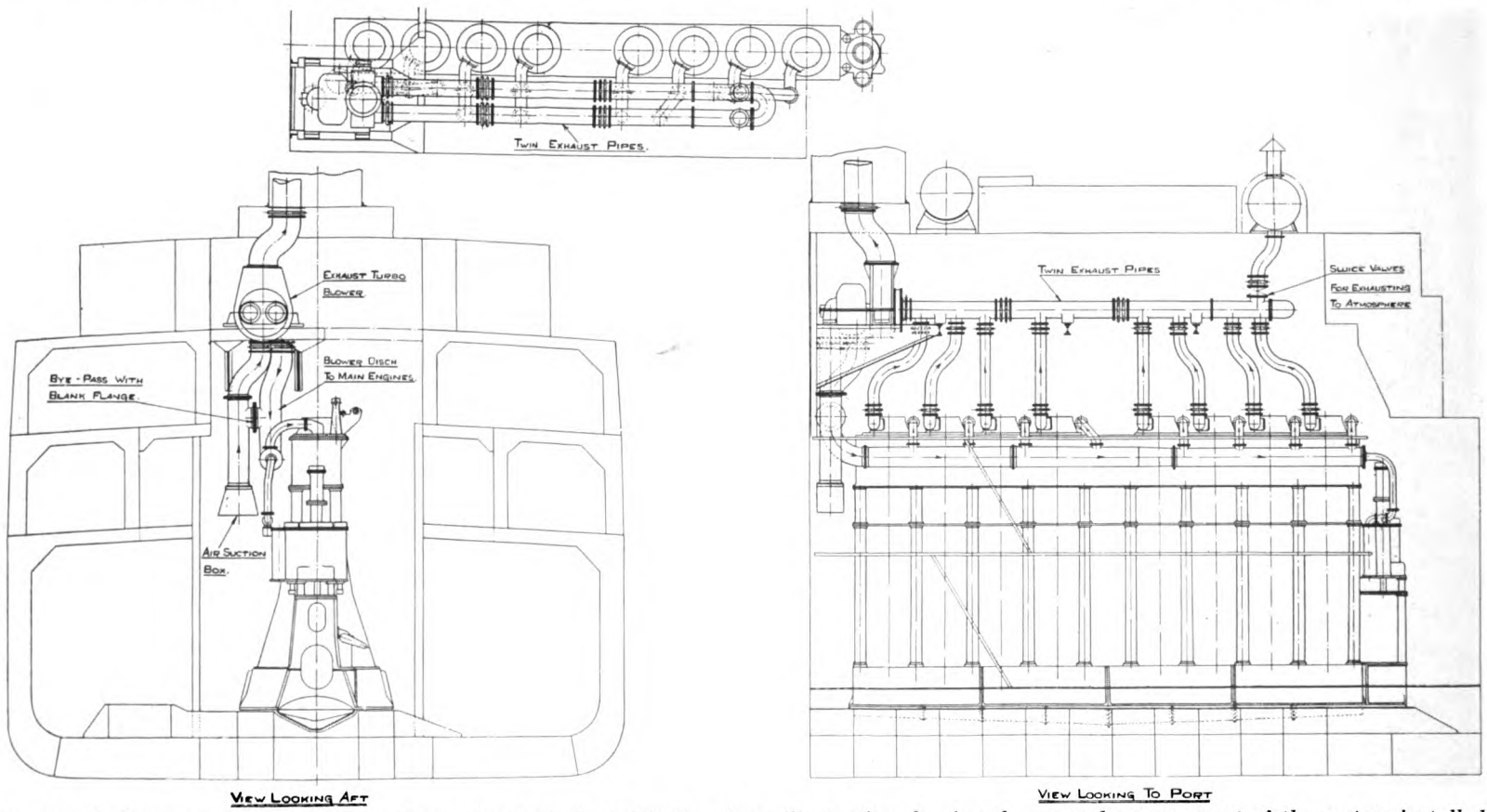
This conversion, so far as Great Britain is concerned, is pioneer work by the North Eastern Marine Engineering Co., as engine builders and James Chambers & Co. as shipowners. The former are the first British licensees to adopt the Buchi system and the RABY CASTLE is the only British ship to be fitted with it at the time of this writing.

The cost of carrying out this work has not been made public and that is not surprising because it cannot be considered as representative of the cost of similar work carried out with the benefit of experience gained with initial work. To produce a ship of greater speed by making an original installation of greater power involves a substantial increase in cost over that of building for lower speed with less power. The firm who made this conversion state: "The cost, weight and machinery space occupied is reduced by a remarkable amount in the case of new tonnage. It should be borne in mind that in this case, being a conversion job, the arrangement is different from what it would be in the case of a new ship."



Considering the power increase the space occupied by the Buchi system is very small

It is well known that the ordinary Diesel engine is limited in power that can be produced with a given cylinder bore, stroke and rate of r.p.m. when the conventional methods of charging and combustion are employed. Consideration must be given to wear and tear on the engine resulting from high combustion pressures and temperature in the cylinders if overloaded. With the Buchi system an extra power of about 50 per cent is said to be obtained without increasing the average temperatures in



Structural changes to the ship were not necessary as indicated in the above illustration showing the general arrangement of the system installed

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the cylinder. This would also be true if the system in its entirety were not employed and an equal amount of air at similar pressure were made available by some means other than utilization of an exhaust turbo blower. It is also true that power produced by an exhaust turbine could be utilized for other purposes. Thus far the turbine offers a certain amount of resistance, to the free passage of exhaust gas, that would likely result in lowered efficiency of the engine if additional pressure, over atmospheric, were not carried at the inlet to the cylinder.

This system is the result of many years of development by Alfred Buchi and was described at length in the Sept. issue of MOTORSHIP.

Prior to making this conversion the RABY CASTLE had been in continuous service since her trial trip in April, 1925. She had covered a total distance at sea of 160,000 miles with a mean average speed on deep laden voyages of 10.95 knots, on a fuel oil consumption for all purposes of 9.414 tons per day. The engines were in excellent condition at the end of this period.

Principal Characteristics of Raby Castle

Length, b.p.	400 ft.
Beam	52 ft. 3 in.
Depth	26 ft. 6 in.
Deadweight capacity	8000 tons

Engine characteristics

Type	4-cycle s.a.
No. of cylinders	8 cylinders
Bore	28¾ in.
Stroke	51¼ in.
Speed	92 r.p.m.
Power, on trial	3000 i.hp.

A general arrangement of the system as applied to the RABY CASTLE, shown in one of the illustrations, indicates that additional engine room space was not required. This is remarkable in view of the fact that approximately 900 i.hp. has been added to the power of the main engine. The turbo blower is located in the after end of the engine room and was supplied by Brown Boveri, Baden. It operates under full power at about 3300 r.p.m. and supplies air to the cylinders at approximately four lbs. per sq. in. With an increase in speed of the ship from 11.9 knots to 13.334 knots and an increase in fuel consumption from approximately 9.5 to 12 tons per day this conversion seems to be fully justified.

Prior to conversion the RABY CASTLE'S machinery was in excellent condition; according to the sponsors of this work it will continue so. As the situation stands at present the Buchi system seems capable of maintaining improved Diesel efficiency and economy.

Results of shop and sea trials before conversion and sea trials after conversion are given in the following table:

Performance Data

	Before Conversion		*After Conversion*	
Description of Trial	Full power shop trial	Full power sea trial	At original full power	At new full power
Date	Dec. 12, 1924	April 4, 1925	Sept. 9, 1928	Sept. 9, 1928
Draught		13′½″	13′9″	13′9″
Displacement		5,600 tins	5,900 tons	5,900 tons
Propeller r.p.m.	95.1	92.5	86.24	96.9
Maximum combustion pressures (mean of all cylinders)	569 lbs.	567 lbs.	542 lbs.	572 lbs.
Pressure in exhaust pipe	Not taken	Not taken	1.93 lbs	3.72 lbs.
Pressure in air main	Not fitted	Not fitted	2.00 lbs.	4.49 lbs.
Mean speed	Not at Sea	11.9 kts.	11.934 kts.	13.334 kts.
Main exhaust temperature (in water cooled pipe)	643.5°F.	587.3°F.	Not fitted	Not fitted
Do. in uncooled pipe (3″ lagging)	Not fitted	Not fitted	621°F.	720°F.
Injection air pressure	975 lbs.	1,000 lbs.	900 lbs.	950 lbs.
Temperature of sea	43.3°F.	Not recorded	57°F.	57°F.
Temperature of cylinder cooling water outlets	84.3°F.	Not recorded	77°F.	83°F.
Temperature of piston cooling water outlets	79.9°F.	Not recorded	85°F.	95°F.
Temperature of lub. oil from guides	Not recorded	Not recorded	80°F.	83°F.
Turbo Blower RPM	Not fitted	Not fitted	2.850	4.037

First of Five Fifteen Knot Motorliners

AN important event in the history of the Nelson Steam Navigation company was the recent sailing of the HIGHLAND MONARCH from Belfast to London on her trial trip. She is the first to be completed of five similar motorships building for the same firm by Harland & Wolff Ltd. These vessels are to enter passenger cargo and refrigerated produce trade between the United Kingdom and Brazil and the Argentine via Spain and Portugal. They have accomodation for 135 first class and 66 intermediate class passengers and a large number of emigrants.

Particulars of the HIGHLAND MONARCH appeared in the June issue of MOTORSHIP, shortly following her launching in May. The following general characteristics are, however, of interest:

Length b.p.	520 ft.
Beam	69 ft.
Depth (to upper deck)	35 ft. 9 in.
Gross tonnage	14,137 tons
Service speed loaded	15 knots
Total power	10,000 b.hp.
Number of cylinders per engine	8 cyl.
Cylinder bore	26.77 in.
Stroke	62.994 in.
Engine speed (normal)	95 r.p.m.
Aux generator output (total)	800 kw.

The Diesels are of conventional Harland-B&W eight-cylinder, four-cycle, double-acting type. They are similar to the six-cylinder Diesels installed in the motorships ACCRA and APAPA with the same cylinder bore and 200 mm less stroke. Of interest is the installation of exhaust gas fired boilers with a heating surface of 400 sq. ft. and capacity of approximately 2,750 lbs. of steam per hour utilizing exhaust gas waste heat. Oil firing permits the boilers to be used in port.

All of the auxiliary machinery is electrically driven with power furnished by four six-cylinder Diesels direct connected to 200 kw. generators. These engines are of standard Harland-B&W trunk piston type.

The refrigerating machinery is a departure from conventional marine practice, and has been built to meet the special requirements of the owners. The plant consists of two independent units, each with a pair of opposed-piston type ammonia compressors direct connected to a four-cylinder *vis-a-vis* oil engine of 240 b.hp. with an operating range of speed from 90 to 180 r.p.m.

The passenger accommodation is exceptionally well arranged and furnished. First class passenger cabins have two-berths and are located on the bridge and shelter decks. The intermediate accommodations are aft, a portion of them having two-berth and the remainder four-berth cabins. The first class dining saloon is paneled in dark oak with dome lighted by Tudor reflector lamps in the style of the Henry VIII Chapel at Westminister. The smoking room like the rest of the public rooms is in oak of light shade with white frieze and shelf ornamentation. Among other attractive features of accommodation is a children's nursery room with ample play space on the boat deck. The lounge and recreation room is paneled in grey oak and has a stage in one end. The floors are laid with Turkish rugs and the furniture is especially suited for South America trade. These vessels promise to become very popular in the trade they will serve.

American shipowners have ordered new ships, but none comparable in economy of operation to the HIGHLAND MONARCH. An illustration of this splendid ship appears on page 926 of this issue.

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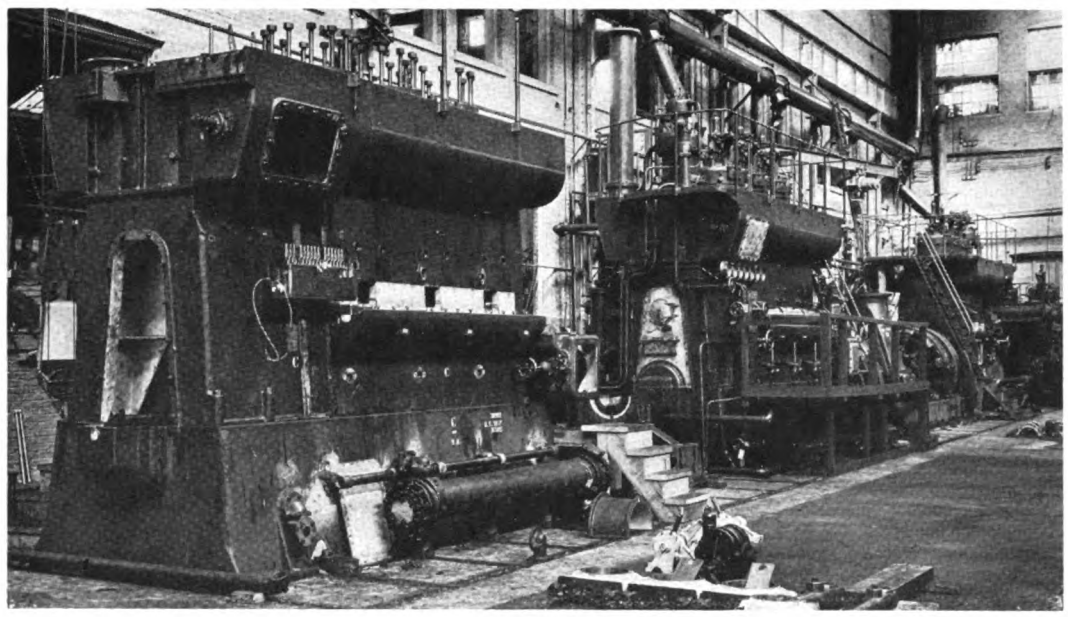
Auxiliary Diesels for Shipping Board Conversions

Accessibility Characterizes Crosshead Type Engines of Latest Nordberg Design

AS a part of the Shipping Board Dieselization program six of the next eight ships to be converted will be equipped with 12 auxiliary Diesels built by the Nordberg Manufacturing Company, Milwaukee. Two of these engines will be installed in each ship and placed on either side of the main propelling unit. Each of the six port side engines will be direct connected to a generator only, and each of the six starboard engines will drive a generator and emergency or auxiliary compressor. Either type of unit can supply all of the electric power required because the generators are of the same size. The compressors may be engaged or disengaged by means of Cutler-Hammer magnetic clutches. The engine on the combined unit will not be required to drive the compressor and generator both simultaneously.



Sturdy construction of the Nordberg Diesels is revealed in this erecting floor view

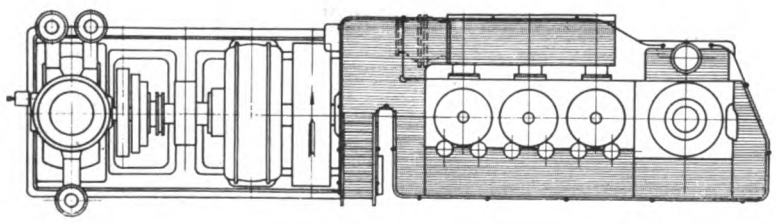
Of design that has met with eminent success the engines are heavy duty, two-cycle, full Diesel port-scavenging type, and operate at 225 r.p.m. They are three cylinder units and the standard Nordberg practice of crosshead construction is employed. Sturdy and rigid construction includes an enclosed frame which does not interfere with accessibility because large aluminum crank case doors provided easy access to the working parts inside. Three major castings, bedplate, frame and cylinder-block are securely tied together with strong tierods that absorb vertical stresses which would otherwise be carried by the castings. A built-up type crankshaft with webs and crank pins in one solid "U" shaped forging and straight forgings pressed together is bedded in main bearings carried by the bedplate.

Into the cylinder block are pressed renewable cylinder liners. At the bottom of these liners are four scraper rings arranged in sets of two. One set scrapes the used oil off the piston preventing it from dropping into, and contaminating, the oil in the crank-case. The other set of rings prevents excessive clean oil from below "pumping" up into the cylinder. Cast integral with the cylinder casting is the manifold carrying scavenging air from the scavenging pump to the power cylinders.

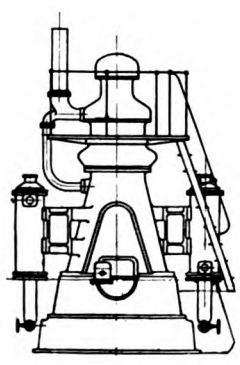
Crosshead guides are of heavy rectangular bar steel, securely bolted and doweled in place. The crosshead slippers are of box type, made of cast steel, babbitt lined and bolted to the bottom of the piston skirt. Also of crosshead type is the reciprocating scavenging pump driven by an extension of the crank shaft. An attached three stage compressor, superimposed on the scavenging pump, and driven from an extension of the scavenging pump piston rod, supplies injection and starting air.

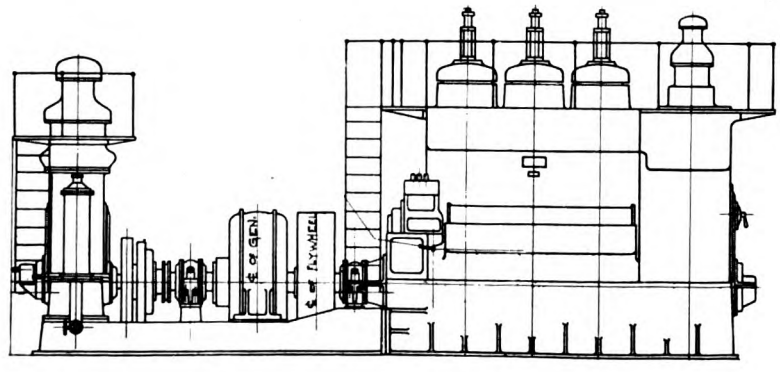
Manzel force feed oilers lubricate the power and compressor cylinders; all other parts are lubricated from the continuous pressure system. After the oil has passed through the various bearings it drains into the trough-like recess of the deep bed plate. A Schutte-Koerting gear pump driven by a drag-crank on the scav-

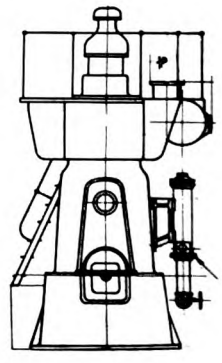
Below — Three elevations showing compact arrangement of engine generator and compressor



Left — Plan view showing tandem hook-up of the compressor unit. The starboard set is the same without compressor







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enging pump crank forces the oil through twin strainers, then through an oil cooler from which it returns to the system.

Lubrication of the reciprocating parts is introduced in a groove turned in each main bearing. Drilled holes in the built-up type crank shaft are in line with this groove and permit the oil under pressure to be forced into the oil passage extending the full length of the shaft. From there it is distributed to the crank pins and up the hollow connecting rod to the crosshead pins and guides.

To ensure ample lubrication of the camshaft and governor shaft connections are arranged to lubricate these from the pressure system. Since the working pistons are oil cooled and only one oil system is used the pump capacity is made ample for both. A portion of the oil which enters the crankshaft and passes through the connecting rods, on reaching the crosshead, passes via a tube into the hollow cast steel piston, and serves as a cooling agent. It then passes through other connections finally spilling into the crank pits and returns to the system. Thermometers are conveniently aranged so that the operator may readily note the piston cooling oil outlet temperature.

The generators supplied with these engines are of the Elliott Company design normally rated at 340 kw., but with an overload capacity of 25 percent for two hours. They are of the two wire commutating pole, flat compounded, 240 volt d.c. type arranged for parallel operation. The armature for each machine runs in two bearings resting on the bedplate.

On the ships in which these engines will be installed additional air for maneuvering, or in case of emergency, will be supplied by the combined unit. The compressors are three stage machines, of Nordberg design, with a capacity of 550 lbs. of free air per minute, at a working pressure of 1000 lbs. per sq. inch. An unloader on the low pressure stage is interconnected with the magnetic clutch controller. When the clutch is disengaged the unloader is held open. Upon engaging the clutch the unloader remains open until the compressor is up to speed, at which time it closes and delivery of air starts.

Air coolers of the straight tube type between stages, and an after-cooler on the high pressure stage are built with especial thought for accessibility, ease of examination and cleaning. Special metals in these will resist deterioration. Cylinders are provided with force feed mechanical lubrication and the bearings are lubricated from the pressure system of the engine.

Sufficient power is provided in the engine of the combined unit to drive either the generator or compressor at full capacity. When installed in the ship the generator end will be forward and the operating side of both engines will be inboard. Both engines turn outboard, making them right and left hand.

They are to operate on the same fuel as does the main propelling engine. They must operate satisfactorily on fuel with the following characteristics:

Gravity baume, 18 to 20 deg.
High heat value, 18,800 to 19,000 B.t.u.
Low heat value, 17,600 to 18,000 B.t.u.
Viscosity Saybolt (fural at 77° F.) 60 to 75 sec.
Sulphur, 1 to 2½ percent.
Water, 1 percent max.
Residue, 25 to 30 percent.

Each engine will be subjected to thorough shop tests and sea trials. While on test, load will be supplied by the regular generator, the power being absorbed by a rheostat. The requirements of the various tests for the first engine, which MOTORSHIP saw on test at Milwaukee, are as follows:

Fifteen days' nonstop run at rated power and r.p.m.
24 hours 10 percent overload.
2 hours 25 percent overload at 225 r.p.m.
2 hours at 10 percent higher r.p.m. than normal at full load.

Test to determine governor action with four hours each at ¼, ½ and ¾ loads and one hour no load.

Each succeeding engine will be tested with a 12 hour non-stop run at rated power and r.p.m., two hours at 25 percent overload and the same tests to determine governor action. During these shop tests observations will be made of load, fuel, lubricating oil, pressures, temperatures, etc.

After installation is made, dock and 12 hour full load sea trials will be made.

Percentage of Motorships Continues to Gain

The volume of world construction of merchant vessels is now at a lower point than in any period since the ending of 1926, says a report just issued by Lloyd's Register, covering returns from all countries for the quarter ended September 30, last. And the present total, it is added, is nearly 600,000 gross tons less than that at the beginning of this year.

The world total of motor vessels under construction at the end of the last quarter was 1,419,602 gross tons, as against 1,500,544 at the close of the previous quarter. The building of vessels of this type now aggregate over 300,000 tons more than the total of all other types of ships combined, and motorships now represent 56.3 per cent of all construction, as contrasted with 51.6 per cent at this time last year. In the quarter ending June 30, last, the proportion was 56.4 per cent, so the present decline is a slight one. The contrast is further shown by the following table of gross tonnage, by Lloyd's:

Date	Sept. 30, 1928	June, 30, 1928
Motor vessels	1,419,602	1,500,544
Other types	1,101,740	1,159,918
World total	2,521,342	2,660,462

San Diego-Coronado Diesel Electric Ferry

COMPLETE electrical equipment of a double ended ferry for the San Diego-Coronado Ferry Company will be supplied by the Westinghouse Electric & Manufacturing Company. The vessel will be built by the Moore Dry Dock Company of San Francisco.

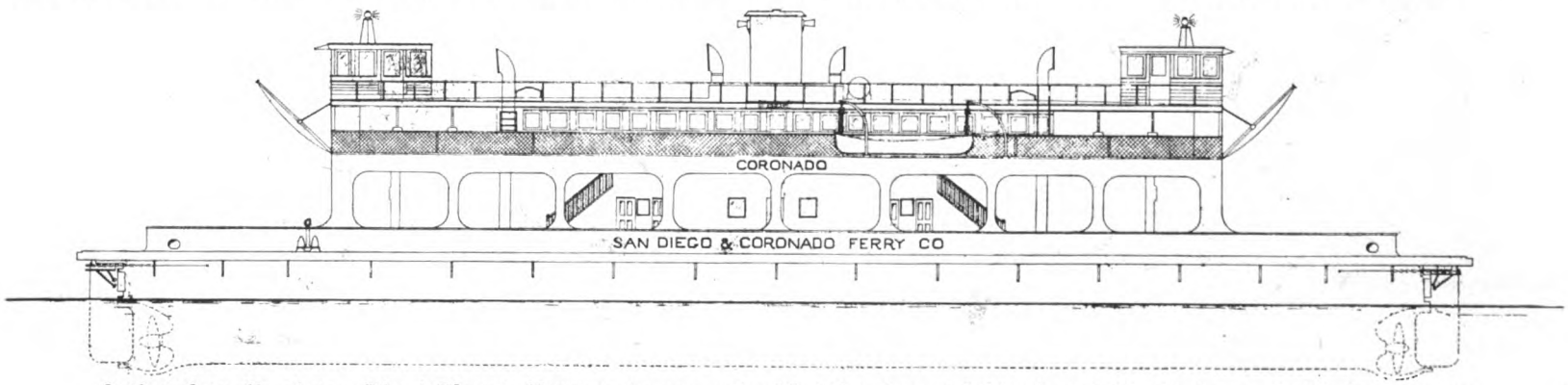
Propulsion equipment will comprise two Atlas Imperial 8-cylinder Diesels of 500 b.hp. each operating at 277 r.p.m. directly connected to 325-kw., 250-volt shunt wound generators and 25-kw., 125-volt compound wound exciters. The main generators are connected in series and supply power to the propulsion motors which will operate in parallel on the propulsion circuit. Switches are provided for cutting either main generator or propulsion motor out of the propulsion circuit.

Propulsion motors are single armature, shunt wound 500 volt machines operating from 150 to 180 r.p.m. Provision has been made in the propulsion circuit so that when the ferry boat is under way the after propulsion motor carries practically all of the load, the forward motor making revolutions sufficient only to eliminate the resistance of the forward propeller.

The main generators and the propelling motors will be separately excited, excitation being taken from a bus which may be connected to either one of the exciters by means of a double throw switch.

The Westinghouse variable voltage system of control will be used, control being arranged in each of the two pilot houses and also in the engine room. There will be two auxiliary power buses, one provided for connection to the No. 1 exciter or to the shore power line while the other is fed by the No. 2 exciter.

This contract brings the total of Westinghouse electrically equipped ferries on the Pacific Coast to nine and makes the seventh Westinghouse Diesel-electric ferry in Pacific waters. Previous installations were four Diesel-electric drive for the Golden Gate Ferry Company, two Diesel-electric drive for the Southern Pacific Company and two for the Key System Ferries.



Outboard profile of new Diesel Electric Ferry to be powered with Atlas-Imperial Diesels and Westinghouse electrical equipment

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Diesels Essential to Tuna Fishing

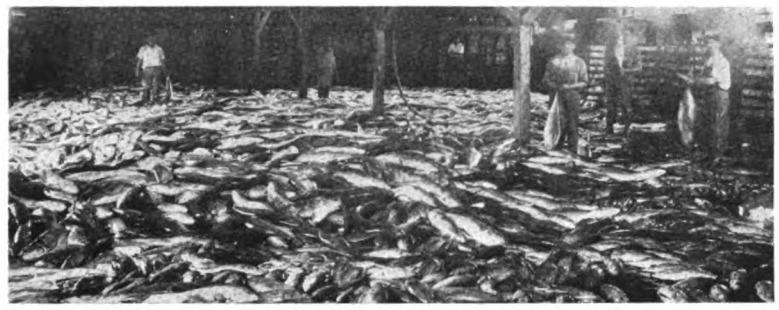
Deep Sea Fishing Trips of 4,000 Miles Are Just Part of the Day's Work

By O. H. Barnhill

THE tuna industry of Southern California is so new that few persons realize its importance, and so before we take up a discussion of the many Diesel-powered boats that are playing a vitally important part in this business, we will present some significant figures.

San Pedro, where most of the tuna is packed, is the second largest fishing center on the western continent and her fish products last year were valued at $13,000,000. The combined output of the Boston, Gloucester and Portland, Me., fisheries the year before was only $9,000,000. San Pedro, with her 1927 pack, valued at $10,000,000, is the largest fish canning point in the United States. Two-thirds of this pack was tuna and the remainder sardines. Seattle's fisheries yielded last year 16,000 tons, worth $3,600,000. The entire Pacific coast salmon catch in 1926, including Alaska, was worth only $10,000,000. Monterey, California, produced last year 94,000 tons of sea food, mostly sardines; San Francisco, 16,500 tons and San Diego, 6500 tons.

San Pedro's fish canneries are valued at $4,000,000, and at the height of the season a total of 6000 persons are employed in the fishing industry. This city of 40,000 population is located at the west end of Los Angeles harbor. Long Beach is at the other end and Wilmington is between. Each of the latter cities have fish canneries, the product of which is included in San Pedro's figures.



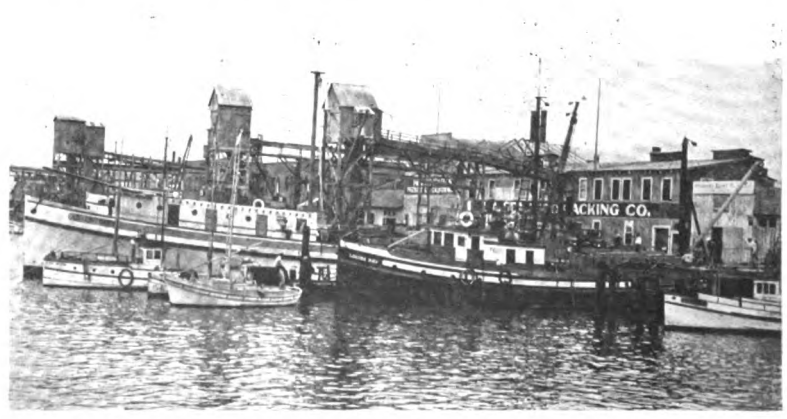
Tuna brought in by Diesel powered boats and valued at more than $6,000,000 *came to San Pedro canneries last year*

San Diego, 100 miles south, also has extensive fish canneries, devoted mostly to packing tuna. Southern California has about 1,250 fish boats, including purse seiners, gig boats, tenders and hook-and-line vessels. There are 60 tenders, some valued at $100,000. The tuna boats number about the same and the newer, better ones cost $50,000 to $80,000 each.

With these important figures in mind let us consider the Diesel engine, which has placed Southern California's tuna fleet on a financially safe and profitable basis of operation. Gas engines in the small fishing boats did very well as long as they worked close to the home ports. When local banks became well fished out these boats were compelled to make round trips to the south of almost 3000 miles. Obviously the gas engine is less suited to such work than the Diesel. The extra cost of fuel alone is a big factor. Making ten such trips per year with gasoline at 17 cents per gallon as compared to Diesel fuel at 3 cents reveals a possible saving of startling magnitude. This more especially in view of the fact that the thermal efficiency of the Diesel is higher, and the heat value of the heavier fuel much greater per measured unit.

An added appeal to the boat owner is simplicity of operation. The Diesel is simpler, more dependable and safer to operate than the gas engine. A sweeping statement, truly,

A typical Diesel tuna fisherman hurrying away to the fishing banks



Part of the fleet will be found at the canneries discharging tuna

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because the heavy duty gas engine is a dependable thing. Elimination of spark and carburetor in favor of high compression and airless injection of the fuel is responsible.

The human element has only improved its fishing methods, and has devoted but little time and attention to a study of the problems of engine operation.

Expert engineers are seldom found on fishing boats; the fishermen themselves often run the engines and so a prime requisite of the power plant is simplicity. Many of these men are sturdy foreigners with little schooling and practically no knowledge of engineering. That such men can operate these engines without running into mechanical difficulties is evidence of perfection

So confident are they of continued successful operation that they venture 1,000 miles or more into Mexican waters, some of them taking no spare equipment with them, because of extensive experience in which such equipment has not been needed.

Fishermen went right ahead with big Diesel tuna boat building

Keen interest in launchings is evidenced by the spectators present

Fishing Methods and the Boat

Some tuna are taken by seining, but most of them are too lively to be snared in this manner. Then the fishermen use a line-and-hook, baited with live minnows. The necessity of taking along a large supply of live bait and of making long cruises with a single vessel has evolved a new type of fishing craft, the tuna boat. This vessel has several distinguishing features. The stern is wide and low, affording plenty of room for hook-and-line fishing and lessening the hand lift of heavy specimens. The wide stern gives room for an immense live-bait box, 10 to 14 ft. wide, 20 to 26 ft. long and 6 ft. deep, made of 3 in. redwood planking and resting upon the after deck. Two or three bait wells extend athwartship immediately in front of the bait box. The combined capacity of the bait tanks is three to five tons of live sardines and 50 to 90 tons of water.

The water is kept in constant circulation by centrifugal pumps, with a capacity of 1,000 gallons or more of water per minute. These pumps are operated by a line shaft or by electric motors receiving power from the main engine or an auxiliary. A continuous flow of water is necessary because the fry will die if left for more than a few minutes in stagnant water.

With cargo hold amidships, engine well forward and smaller cargo holds built in each end of the boat, the larger vessels have a capacity of 100 to 175 tons of iced fish. The biggest tuna boats are 100 to 115 ft. long, 25 ft. beam and 10 ft. in depth, from deck to keel. The open hold in the center prevents piling up enough keelsons to give a strong backbone, as in sailing vessel construction. Extra heavy wood structure would make it sufficiently rigid to prevent hogging; only a few fishermen however, saw the necessity of heavy construction in earlier days. One recalls a two-year-old boat that hogged five inches. The HERMOSA, after running on the rocks, pounded to pieces in a few hours. Such things could not happen to the larger, stronger boats now building. Operators are learning, by experience, to build more substantial fishing craft.

It is said that very large wooden boats are impractical, because of the great bulk of timber required for strength. Naval architects disagree on the question of a dividing line between wood and steel. Some say 100 ft., others 125, and one designer is in favor of adopting steel when ⅜ in. hull plates are justified.

The performance of the new steel boat, ORIENT—an outstanding example of this type of craft—first all-steel tuna boat built on the Pacific coast, is being watched with interest. She may be the forerunner of a fleet of new steel fishing craft.

The typical tuna boat has a cabin well forward, a spacious forward deck and a wide forward flare of hull. The bow has a comparatively large under-water bulb to support the machinery weight. The 400 b.hp. Fairbanks-Morse Diesel and other equipment in Guy Silva's new EMMA R.S. weighs 40 tons, while one of the 300 s.hp. Union Diesels, in M.O. Medina's ATLANTIC and other vessels built by the Campbell Machinery Company, weighs 26 tons. The timbers supporting this weighty machinery are extra heavy. John Santos' SACRAMENTO, has a keel and a keelson each 16 in. by 16 in., sister keelsons 12 in. by 14 in. and two foundation timbers 16 in. by 16 in. by 75 in. long. This boat has a length of 110 ft., beam 25 ft. and depth of 10 ft. She is powered with a 400 b.hp. Diesel.

Mexican Export Duties

Bait fry are not netted as needed on the Mexican coast, because the tuna boats clear for the high seas and thus avoid payment of Mexican export duties.

Beginning a few years ago with a modest tax of five dollars per ton on all fish taken off their coast and sold in the United States, Mexico gradually raised the fees until they totalled forty dollars per ton. The advent of California's big Diesel-powered tuna boats, carrying a full supply of live bait and sufficient fuel oil for 4,000-mile cruises, alarmed the Mexican government, which was threatened with the loss of important revenue.

Last year we paid our sister republic $600,000 on 31,000 tons of fish taken off her coast. Mexico tentatively proposed to reduce her fish fees to $20.83 per ton, provided we would pay duty on all fish taken off her coast, regardless of distance from shore. An alternate proposal was a blanket concession costing our fishermen $900,000 per year. Neither of these proposals met with favor amongst the fishermen, who went right ahead with their Diesel-boat program. Meanwhile, the customary 260 American vessels fishing in Mexican waters had fallen off to 30 by October first.

Seeing the handwriting on the wall, the Mexican government made haste to reduce their export fish tax to twenty-one dollars and forty cents per ton. Large boats operating outside the three-mile limit will be taxed five dollars per ton for anchoring privileges. This sweeping reduction in Mexico export fish tax is directly traceable to the Diesel-powered tuna fleet. It has aided the small boats, and dozens of them are now preparing to re-enter Mexican waters in search of skipjack and yellowfin. The final outcome will be more revenue for Mexico, more profit for packers and fishermen and general stabilization of the fishing industry in the Pacific Southwest.

Before Diesel Power Entered

California fish packers have sent large fish tenders into Mexican waters, with fleets of small boats to catch tuna. Many of these vessels were schooners 60 to 80 ft. in length, towed with tug-boats. The cost of operation averaged about 100 dollars a day. Contrast this with the Diesel-powered ATLANTIC'S fuel cost of 35 cents per hour and 14 dollars worth of lubricating oil on a 2,500 mile trip; operated by members of the fishing crew only. The cost of sending a tender and several small boats to Turtle Bay, 350 miles south of San Diego, is about 25,000 dollars. No wonder the canners welcome the Diesel tuna fleet.

Mechanical refrigeration is another important adjunct to Mexican tuna fishing. Because of the high atmospheric and water temperatures prevailing off the coast of Lower California, it is necessary to pack the catch in crushed ice. The great bulk and high cost of ice, together with its perishable nature, limits the quantity which can be carried on non-refrigerated boats. This limits the length of the cruise and time which a vessel can remain away from the home port. It has resulted in tenders and small boats being compelled to return to port before they caught a full fare, or with fish which had begun to decay and were sold at unprofitable prices.

Automatic cooling machines, with cork-insulated holds, is changing all this. Boats

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so equipped may remain on the fishing grounds for several weeks and return with full cargoes of perfectly fresh fish. York, Lipman, Vilter and other standard makes of compressors with five to eight tons capacity are popular. These machines are now becoming standard equipment on all large fishing vessels. Atlas-Imperial, Washington-Estep, Fairbanks-Morse, Union, and Western-Enterprise are the principal makes of Diesels used in tuna boats. The sea speed averages about ten knots. ORIENT and Manuel Rosa's LUSITANA made eleven knots on their trial runs.

Selling and Financing Diesels

Competition is keen between engine agents. They sometimes cut prices! The customary method of financing is for the purchaser to make a down payment to the engine builders of one-fourth to one-third of the purchase price and agree to pay the balance in eight quarterly installments. One of the fish canners guarantees payment of the engine note. He takes a first mortgage on the boat for security and receives the entire catch. Either the packer or boat builder borrows money to pay for the hull and other equipment, for which a contract or second mortgage is given.

At the end of every three months the net proceeds is divided on a share basis. Each member of the crew, which numbers eight or ten men, receive one share and a previously agreed number of shares is apportioned to the boat. Large boats receive five or six shares, smaller ones as low as two shares. From the price of the fish delivered the packer deducts the cost of fuel oil, food and other supplies used during the quarter, then divides the remainder of the money in the manner just described. After making the engine payment out of the boat's shares, whatever is left is applied on the hull and other equipment.

A 70,000 dollar boat owned by seven partners paid for itself in a single season, not counting wages for the crew, which was composed of the owners. Another boat brought in over 1,000 tons of tuna in one year. These, however, are exceptional cases; many operators find it difficult to make expenses and wages for the crew.

The tuna's movements are uncertain and not well understood. This makes capture in paying quantities difficult and a good deal of a gamble. New tuna banks of vast extent, however, are being discovered and explored, some of them 1,500 miles south of the California-Mexico boundary line. The new type boats can work these grounds, safely, comfortably and economically. The result promises to be a greater and cheaper supply of tuna, resulting in lower prices to the consumer and an enlarged market for the product. This in turn will make business for more and bigger boats, with attractive profits for all interests connected with the tuna industry. This in turn will result in more boats and an enlarged Diesel market.

Diesel Tuna Boats of the California Fleet

Boat Owner	Name of Boat	Operating for	Dimensions, Length, Beam and Depth in Ft.	Cost of Boat Complete	Power and Make of Engine	Boat Builder	Naval Architect
Frank Silva	St. Therese	Cohn-Hopkins	108 x 23 x 10	$60,000	375 Western-Enterprise	Peter Rask	
Seki & Sakamoto		Calif. Packing Co.	110	$55,000	375 Western-Enterprise	Al Larson	Al Larson
Joaquin Medina		Van Camp Sea Food	115 x 23 x 10	$65,000	375 Western-Enterprise		
Sakamoto & Seki	Taiyo		112 x 25 x 11		375 Western-Enterprise		
Manuel Rosa	Lusitania		99 x 22 x 9	$55,000	300 Western-Enterprise	Al Larson	Al Larson
George Shiba	Mission		98 x 19 x 10		250 Western-Enterprise	Al Larson	Al Larson
Hashimoto	Ubuyu Maru				180 Western-Enterprise		
A. Castignola	Contraverde		80 x 19 x 10		180 Western-Enterprise		
Tony Cordich	Jugo Slavijia		80 x 19 x 10		160 Western-Enterprise		
Pete Demorio	Alecksander	French Sardine Co.	80 x 18		160 Western-Enterprise	Harbor Boat Works	
Fred Shelling	Betty B.		70 x 18		80 Western-Enterprise		
Steve Malkovich	California No. 2		70 x 18		110 Western-Enterprise	Al Larson	
A. Castagnola	Conte Verde		80 x 19 x 10		180 Western-Enterprise	Al Larson	
R. Chiba	Enterprise		98 x 20		250 Western-Enterprise	Al Larson	
V. Karmelich	Gallant		80 x 20		180 Western-Enterprise	L. A. Shipyard	
Tom Creese	Gallico		60 x 16		65 Western-Enterprise		
Manuel Medina	Greyhound		115 x 23	$65,000	450 Western-Enterprise	Numes Boat Works	
Manuel Medina	Greyhound		115 x 23		30 Western-Enterprise		
Justo Pesutich	Humanity		65 x 16		110 Western-Enterprise		
Major C. D. Lang	Intrepid		110 x 18		110 Western-Enterprise		
Tony Kordich	Jugo Slavija	French Sardine Co.	80 x 19 x 10		160 Western-Enterprise	Al Larson	
Manuel Rosa	Lusitania		101 x 23 x 9	$55,000	300 Western-Enterprise	Al Larson	
Morgan Brothers	Morgan		110 x 18		110 Western-Enterprise		
Geo. Kobayashi	Nisshin		98 x 19 x 10		250 Western-Enterprise	Al Larson	
Coast Fishing Co.	Orion		70 x 15		110 Western-Enterprise	Al Larson	
Manuel Silva	San Gabriel		65 x 16		110 Western-Enterprise	Robbins Boat Works	
Peter Dragish	Sea Rider		76 x 20		160 Western-Enterprise	L. A. Shipyard	
Stafford Pack. Co.	Siella	Stafford Packing Co.	70 x 18		110 Western-Enterprise	Al Larson	
Frank Silva	St. Therese		108 x 23 x 10	$60,000	375 Western-Enterprise	Peter Rask	
Frank Silva	St. Therese		108 x 23 x 10	$60,000	45 Western-Enterprise	Peter Rask	
H. Kizu	Success No. 3	L. A. Seafood Packing Co.	70 x 18		110 Western-Enterprise		
S. Oka	Sweet No. 2		65 x 16		80 Western-Enterprise		
Kinijiro Sakamoto	Taiyo	California Packing	110 x 25	$55,000	375 Western-Enterprise	Al Larson	
Kinijiro Sakamoto	Taiyo	California Packing	110 x 25		45 Western-Enterprise	Al Larson	
A. Hashimoto	Ubuya Maru No. 2	So. Calif. Fish Co.	80 x 18		180 Western-Enterprise	Al Larson	
John Benson	Uncle Sam	Cohan Hopkins Cannery	70 x 18		135 Western-Enterprise		
	Westmaco	Van Camp Cannery.	65 x 15		90 Western-Enterprise		
Y. Nakasuji	Wn. Enterprise		86 x 17 x 9		200 Western-Enterprise	Al Larson	
Matsuuki & Sugiyama	Southern Cross	Coast Fishing Co.	118 x 26		450 Western-Enterprise	Brewster Shipyard	
M. F. Correia	Glory of Seas	Van Camp Sea Food	118 x 26 x	$65,000	400 Union	D. Brusstar	
J. C. Monise	Mariner	Van Camp Sea Food	115 x 25 x 11	$65,000	350 Union	Campbell Mch Co.	Manuel Madruga
Fred Canepa	Stella Di Genova	Cohn-Hopkins	112 x 25 x 10	$65,000	300 Union	Peter Rask	Peter Rask
August Felando	Adventurer	Van Camp Sea Food	115 x 25 x 10	$65,000	300 Union	Harbor Boat Bldg. Co.	
M. George	Shina No. 2	San Diego Pk. Co.	65 x 14-6	$21,000	75 Union	Campbell Mch. Co.	Manuel Madruga
M. Crivello	Oceana	Cohn-Hopkins	65 x 14-6	$24,000	90 Union	Campbell Mch. Co.	Manuel Madruga
M. Tavares	Supreme	San Diego Pk. Co.	65 x 14-6	$21,000	75 Union	Campbell Mch. Co.	Manuel Madruga
J. Zolezzi	Balboa	Independent	80 x 18	$34,000	100 Union	Campbell Mch. Co.	Manuel Madruga
Victor & Manuel Goularte	San Joaquin	Van Camp Sea Food	78 x 17-6	$32,000	150 Union	Campbell Mch. Co.	Manuel Madruga
John Canepa	Princess	Independent	55 x 11	$15,000	55 Union	Campbell Mch. Co.	Manuel Madruga
Ocean Industries Co.	Kazuyo	Calif. Pack. Corp.	58 x 10-6	$15,000	55 Union	Campbell Mch. Co.	Manuel Madruga

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Frank Alioto	Miss America	Calif. Pack. Corp	58 x 10-6	$15,000	55	Union	Campbell Mch. Co.	Manuel Madruga
Joe M. Medina	Olympia	Van Camp Sea Food	95 x 18-6	$45,000	225	Union	Campbell Mch. Co.	Manuel Madruga
Manuel Freitas	Del Monte	Calif. Pack. Corp	95 x 18-6	$45,000	225	Union	Campbell Mch. Co.	Manuel Madruga
John Cardoso	St. Varonica	Calif. Packing Co	115 x 25 x 8	$65,000	300	Union	Campbell Mch. Co.	Manuel Madruga
M. Silvera	California	Calif. Packing Co	115 x 25 x 8	$65,000	300	Union	Campbell Mch. Co.	Manuel Madruga
M. O. Medina	Atlantic		110 x 23 x 6		300	Union	Campbell Mch. Co.	Manuel Madruga
Wm. Maggio	Hermosa				520	Fairbanks-Morse		
Theodora & Sousa	Orient	San Diego Pk. Co	112 x 25 x 9	$80,000	350	Atlas-Imperial	L. A. Shipbuilding Corp.	G. B. Newby
Medina & Sons	Funchal	Van Camp Sea Food	113 x 95 x 10	$65,000	350	Atlas-Imperial	Nunes Bros.	
M. M. Perry	Point Loma	K. Hovden Co	95 x 23 x 7	$50,000	300	Atlas-Imperial	San Diego Marine Co.	
M. Crivello	G. Marconi	Cohn-Hopkins	83	$35,000	200	Atlas-Imperial	Peter Rask	
Nick Dragich			80 x 20 x 10		200	Atlas-Imperial	Al Larson	
Frank Mitchell	Vasco De Gama	Van Camp Sea Food	82 x 20 x 10		200	Atlas-Imperial	Peter Rask	
Sam Felipe & Bompenserro	Milwaukee		75 x 18 x 6-6		125	Atlas-Imperial	Peter Rask	
Allen	A. B. Carpenter		148 x 24 x 11		350	Atlas-Imperial		
M. Luz	Hawk I		66 x 17 x 8		110	Atlas-Imperial	Garbutt & Walsh	
Matt Zovich	Gloria R.		75 x 17 x 8		125	Atlas-Imperial		
N. Ardito	N. Ardito		60 x 15 x 7		75	Atlas-Imperial		
J. Jose	Lisboa		72 x 18 x 9		125	Atlas-Imperial	Peter Rask	
John Mezich	Ambassador		62 x 16 x 7½		100	Atlas-Imperial		
Martinovich & Grbelja	Vitality		84 x 20 x 8½		200	Atlas-Imperial		
Stanovich & Holata	Louise Ray		70 x 18 x 9-8		100	Atlas-Imperial		
Theodora & Sousa	Orient		112 x 25 x 9	$80,000	350	Atlas-Imperial	L. A. Shipbuilding Corp.	G. B. Newby
John Gabelich	Marie Joan		77-8 x 19-2 x 8		180	Wash.-Estep	J. M. Martinac	
Dick Suryan	Lindbergh		72-9 x 18-6 x 8-9		180	Wash.-Estep	Lake Wash. S.B. Co.	
T. Inouye	New Monterey	Calif. Pack. Corp	80 x 19 x 9		180	Wash.-Estep	Al Larsen	
Jerry Acalin	Acalin		77 x 19-6 x 6-10		180	Wash.-Estep		
A. Kordich	Oregon		68 x 16-8 x 7-4		90	Wash.-Estep	Western Boat Bldg. Co.	
John Santos	Sacramento		110 x 25 x 11		400	Fairbanks-Morse		
Guy Silva	Emma R. S.	Van Camp Sea Food	95 x 23 x 7	$50,000	400	Fairbanks-Morse	San Diego Marine Construction Co.	
E. Caginola	Contra Costa	Westgate Packing Co.	78	$26,000	360	Fairbanks-Morse	Al Larson	Al Larson
Yamaguchi & Tomeido	Flying Cloud	Westgate Packing Co.	105	$58,000	360	Fairbanks-Morse	D. Brusstar	
Santos & Sousa		Van Camp Sea Food	110	$55,000	360	Fairbanks-Morse	Al Larson	Al Larson
A. Ryono		Van Camp Sea Food	80	$35,000	215	Fairbanks-Morse	Harbor B. B. Co.	
Guy Silva	Lois S.		75		120	Fairbanks-Morse		
Patricia Corp	Patricia		90 x 22	$60,000	240	Worthington		Lamble & Maeda

Diesel Workboats On the Pacific Coast

Installation of a Vickers Petter medium compression 200 b.hp. oil engine is being made in the Tug St. Clair No. 2 at Vancouver, B. C.

The 250-ton Mexican motorvessel Salvatierra is having her stern rebuilt and bottom replanked while changing her shaftline at the Harbor Boat Building yards, San Pedro. She is expected to be ready for service early in November.

Oil for Diesels and gasoline for other motors is being carried to the fishing and workboat fleet on the lower Columbia River by a floating service station recently completed by the Standard Oil Company, at Astoria, Ore. The craft is a converted 26 ft. all-steel lifeboat, driven by a 17 hp. Johnson Big Twin outboard motor.

One of the fastest, as well as one of the most powerful, seine boats on the Pacific Coast went into service for the Imperial Trading Company, of Nanaimo, B. C., not long ago. This is Departure Bay No. 2, with an overall length of 75 ft.; beam, 16 ft. 2 in.; molded depth, 8 ft., driven by a four-cylinder, four-cycle 100 hp. Washington-Estep Diesel engine.

The new airless injection Hill Diesel has been introduced at Tacoma, by A. M. Hunt & Son, ship chandlers and marine engine dealers of the Washington port. This engine, described in September Motorship, is suitable for cruisers as well as for workboats. This firm recently installed a 54 hp. Kahlenberg oil engine in the 65 ft. freighter Toando, operating between Tacoma and Shelton.

Young Bros., Ltd., of Honolulu, has just placed a contract for a 125 ft. tug which is to be equipped with two 520 hp. Model 37 Fairbanks-Morse Diesels with built-in auxiliaries. The tug has been designed by L. H. Coolidge, naval architect of Seattle, who will supervise construction. She will be built by the Ballard Marine Railway Company, builders of the Mahoe, and is to be ready for delivery in March.

Nunes Brothers, boat builders of Sausalito, California, have just completed the tuna boat Funchal, described in September Motorship. She was built for Corriea & Corriea, San Diego fishing concern, at a cost of approximately $75,000, and is equipped with a 350 hp. Atlas-Imperial Diesel. An ice plant of eight-ton capacity for freezing fish is part of her modern equipment. The owners will make 300-mile trips of about three weeks' duration, south of San Diego for tuna.

The Wood & English Company's tug boat Ellison, built at Englewood, B. C., has been equipped with a 4 cylinder 100 hp. at 400 r.p.m., two-cycle Fairbanks & Morse Diesel. The Ellison measures 56 ft. o. a., 13 ft. beam and 7 ft. draft. She will be used for log towing in connection with this company's logging camps, on the British Columbia coast.

The Merchants Transportation Company of Tacoma's new Diesel freighter Belana is now in service between Tacoma and other Sound ports. The power plant is one 210 b.hp. Fairbanks-Morse Diesel. There is also a 45 b.hp. Diesel of the same make for air compressor and bilge pumps and one 10 hp. motor for electric light and auxiliary compressor. The Belana is a vessel 105 ft. 6 in. long by 31 ft. 6 in. beam and a depth of 9 ft. 6 in. The freight capacity is 400 tons.

The largest vessel in the Southern California tuna fleet will be the Hermosa, now being converted from a passenger steamer to a Diesel fish boat at the Los Angeles Shipyards, San Pedro. With a length of 150 ft., beam 26 ft. and depth of 11 ft., she has a cargo capacity, 225 tons of iced fish. The bait box will hold 7 tons of live sardines and 120 tons of salt water. Accommodation will be provided for a crew of 14 men.

A rather new type of salmon troller, at least so far as speed is concerned, is romping along the northern California coast at 12 m.p.h., driven by a 75 hp. Fairbanks-Morse Diesel engine. She is Gloria H., owned and operated by Fred Hyman, of Eureka, California, and built to his order by the Astoria Shipbuilding Company, Astoria, Ore. She is 54 ft. long, but has only 14 ft. beam, with wide, reverse bows, and a hull designed for speed. Gloria has two large fish holds and two booms, so that she can be used in the halibut fisheries as well as for salmon. Hoists, anchor winch and other equipment is operated from the main engine.

The U. S. Army boat, "L-63," was launched last month at the Harbor Boat Building yards, San Pedro. After testing with a 120 hp. Union Diesel, the engine will be removed so the boat and engine may be shipped separately from San Francisco to the Philippines.

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A Typical British Columbia Diesel Tug

BOATS of almost equal size and similar type are frequently found in fleets in certain maritime districts. But, it is not a matter of adherence to popular styles and models that make an appeal to the eye. It is a matter of utility. Local boat owners build in accordance with the findings of associate operators in their own districts.

They pool a vast knowledge, gained through practical demonstration of the general utility of a certain type of boat. This pooling of general knowledge is perhaps more casual than deliberate, and results from observation of what the other chap is accomplishing with his latest innovation.

After a time the ideas incorporated in a new design, if good, become an accepted standard and no longer an innovation. An example of this trend toward a definite type of boat in certain districts, is found in the Diesel tug J. M. McKENZIE. She was built this season by the McKenzie Barge & Derrick Company of Vancouver, B. C., for their own use.

In British Columbia the harbor and short trip work falls to the lot of Diesel-tugs that can be operated by a single crew, consisting of a captain and engineer and the deckhand who also acts as cook. There have been a number of these boats from 50 to 60 ft. in overall length built on the British Columbia coast in recent years. The average power is in the neighborhood of 100 b.hp. Different engines are used including Union, Atlas Imperial and Washington-Estep in the 4-cycle class; Fairbanks-Morse in the 2-cycle class; and Gardner, Kahlenburg and other surface ignition oil engines of responsible make.

As a rule the boats of this size are built of fir with steam-bent oak frames; some of them have an outer sheathing of hardwood. They are used principally for towing scows loaded with export lumber in transport from the saw mills to ocean freighters and to loading terminals. Others are used for depositing booms of logs around the harbor from the boom grounds to the various mills and ships.

J. K. McKENZIE is a good example of this type of Diesel tug. Her overall length is 57 ft. and molded beam 15 ft. She is planked with fir 2 in. finish over 2½ in. by 5 in. steam bent oak frames spaced 10 in. between centers. An outer sheathing of iron-bark extends from below the waterline to the guard and protects the hull proper from abrasions resulting from floating grit.

Her engine is a 3-cylinder 4-cycle Union-Diesel with a bore of 10 in. and stroke of 15 in. giving a power of 110 b.hp. at 25 r.p.m. It turns a bladed propeller 60 in. in diameter with a 38 in. pitch, which is indirectly connected to the engine by means of a set of revolving gears and clutch, that are used for maneuvering.

A very useful part of the J. K. McKENZIE'S equipment is a towing winch operated through a chain drive and shafting from the main engine. Electric generator is also operated by the main engine, and charges a large capacity storage battery which supplies current for lighting purposes and to operate a searchlight.

With a fuel capacity of 2,000 gallons in wing-tanks loaded in the after part of the engine room, she has a large cruising radius. This adds greatly to an essential continuity of operation, and the profits to the owners resulting therefrom. As a tender to derrick scows and on general towing in the vicinity of Vancouver, time lost in frequently refueling, as in the case of the steam tug would materially reduce the profit. Thus we find that the existing arrangement of the McKENZIE is a highly satisfactory one for the work in which she is engaged.

This little tug is ready to tackle a fleet of barges, an ocean freighter or a raft of logs and put them in their places

Diesel Work Boats in the Northwest

Milton Smith, of Rainier, Wash., has taken delivery on the 45 ft. general utility workboat DECK BOY, from the yard of the Wilson Boat Building Company, of Astoria, Ore.

URANIA, 68 ft. x 19.5 ft. x 7 ft. purse-seiner, owned and operated by Anthony Legaz, of Seattle, has been given a new 75 hp., direct reversing standard Diesel engine, turning a 46 in. x 34 in. McLaughlin wheel at 416 r.p.m., and giving the boat a speed of 10 knots.

Alaskan packing companies have been showing a tendency for the past two or three years to equip their steamers and sailing ships with Diesel-powered tenders. Latest of these is AMAK, recently delivered to the Alaska-Portland Packers' Association as a tender to the large schooner NORTHKING. This tender is equipped with a six cylinder, 160 hp. Atlas-Imperial Diesel.

SKOOKUM CHIEF, a motor freighter operated by the Puget Sound Freight Lines between Tacoma, Olympia and Shelton, Wash., reports the handling of an average of 270 tons of freight per trip, at an average speed of 9.5 m.p.h., at a cost of 54.6 cents per hour. This freight-carrier is equipped with two 100 hp. Washington-Estep Diesels, operating twin propellers in tunnel stern. The craft is 130 ft. long, and is one of the largest motor freighters on the Pacific Coast.

BELANA, a 105.5 ft. freighter, with capacity for 400 tons of freight and twelve passengers, has been put into service between Tacoma and other Puget Sound ports for the Merchants Transportation Company, of Tacoma. This craft is of 31.5 ft. beam and 9.5 ft. depth of hold, of extra-heavy construction, driven at 12 m.p.h. by a 210 hp. Fairbanks-Morse Diesel. A 45-hp. Diesel of the same kind furnishes power for air compressor, winches, electric light generator and other auxiliary machinery. Steam heat and hot water are furnished by a boiler on the main deck aft.

Small Diesels are finding favor in the towing work of Nelson Spencer, Ltd., of Vancouver. About a year ago they installed a three cylinder four-cycle Atlas-Imperial Diesel of 50 b.hp. in a 30 ft. tow boat, and recently have installed a three cylinder 30 hp. at 475 r.p.m. of the same make in a smaller craft, measuring only 26 ft. overall by 7 ft. beam. This engine weighs 4600 pounds with the reverse gear, and turns a three blade propeller of 32 in. diameter and 20 in. pitch. This boat is fitted for one man operation, and is used for handling small booms of logs inside the harbor.

A smart ketch designed by T. Halliday for the Union Trading Company of Vancouver, for cruising the British Columbia coast, measures 50 ft. overall, 13 ft. beam and 6 ft. 9 in. draft. She is designed with raised forecastle and poop decks, and a trunk over the cabin amidship. There is an 11 x 10 ft. saloon aft, with galley on one side of the engine-room adjoining. Two 5½ x 12½ ft. staterooms are laid out amidship, and there is a two berth forecastle. The toilet and a bath are on opposite sides of the engine-room. This boat will carry 1200 sq. ft. of working sail, and a spinnaker. She will have a 6 ton iron keel and she will probably be built of teak with sawn frames 3 x 2¾ in. double, and spaced 15 in. between centers. The engine planned for installation is a two-cylinder 30-35 hp. Climax surface ignition Diesel.

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